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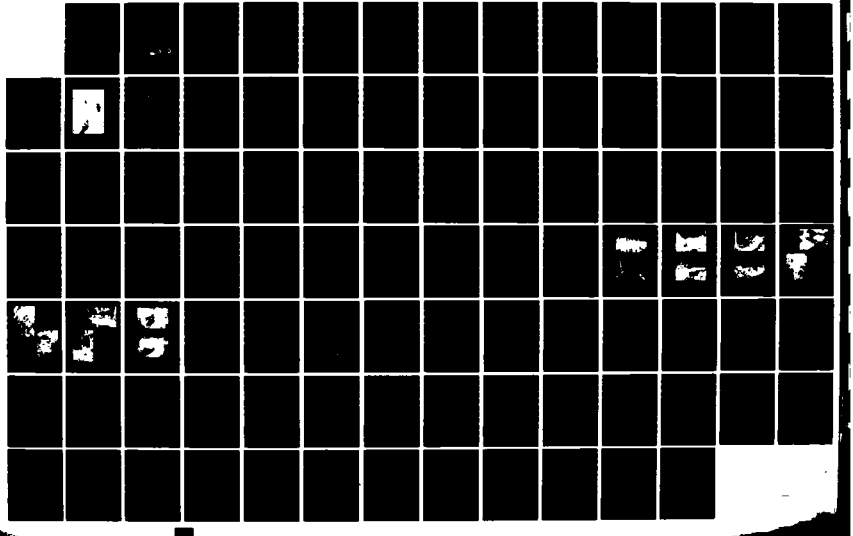

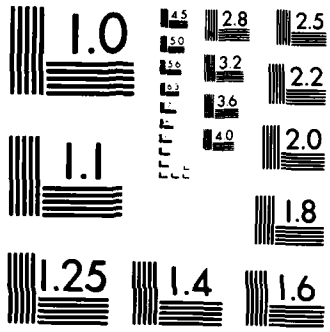

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QUINEBAUG RIVER BASIN
GLOCESTER, RHODE ISLAND

CLARKVILLE POND DAM
RI 01309

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

MARCH 1981

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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4. TITLE (and Subtitle) Clarkville Pond Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
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11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE March 1981 13. NUMBER OF PAGES 53
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18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Quinebaug River Basin
Glocester, Rhode Island
Mary Brown Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a stone wall earth embankment about 400 ft. long witha maximum height of 14 ft. The dam is considered to be in poor condition. To assure the long term performance of the dam, several items of con-cern require further attention. The dam is small in size with a high hazard potential. The test flood is ½ the PMF. There are various remedial measure which must be undertaken by the owner.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:

JUL 21 1981

NEDED

Honorable J. Joseph Garrahy
Governor of the State of Rhode Island
State House
Providence, Rhode Island 02903

Dear Governor Garrahy:

Inclosed is a copy of the Clarkville Pond Dam (RI-01309) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. This report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis.

The visual inspection of Clarkville Pond Dam has revealed the dam to be in poor condition with seepage and structural problems that could affect its future performance. In addition the preliminary hydrologic analysis indicates that the spillway capacity would likely be exceeded by floods greater than 15 percent of the Probable Maximum Flood (PMF). Our screening criteria specifies that a dam classified as high hazard with a spillway capacity insufficient to discharge fifty percent of the PMF be judged as having a seriously inadequate spillway. Because of the concerns with the condition of the dam and the inadequacy of its spillway, the dam is assessed as unsafe until corrective measures are made.

We recommend that the owner immediately after receipt of this report engage the services of a qualified registered engineer in order to accomplish the recommendations in Section 7. Based on the engineers recommendations, appropriate remedial mitigating measures should be designed and completed within 12 months of this date of notification. In the interim, a detailed emergency operation plan and warning system should be promptly developed and round-the-clock surveillance be provided during periods of heavy percipitation or high project discharge.

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NEDED-E
Honorable J. Joseph Garrahy

I approve the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the program.

Copies of this report have been forwarded to the Department of Environmental Management and to the owner, Mr. John Abbott, Pawtucket, Rhode Island. Copies will be available to the public in thirty days.

I wish to thank you and the Department of Environmental Management for your cooperation in this program.

Sincerely,

C. E. EDGAR,III
Colonel, Corps of Engineers
Commander and Division Engineer

Incl
As stated

QUINEBAUG RIVER BASIN
GLOCESTER, RHODE ISLAND

CLARKVILLE POND DAM
RI 01309

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

MARCH 1981

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

Identification No.:	RI 01309
Name of Dam:	Clarkville Pond Dam
Town:	Glocester
County and State:	Providence, Rhode Island
Stream:	Mary Brown Brook
Owner:	John Abbott
Date of Inspection:	14 November 1980

BRIEF ASSESSMENT

Clarkville Pond Dam is a stone wall, earth embankment structure approximately 12 feet wide at the crest and 400 feet long. It has a maximum height of approximately 14 feet. The upstream slope is partially covered with riprap and on the downstream side of the dam there are two dry masonry walls, a 3 foot high knee wall and an 8 foot high stone wall.

The spillway, located near the left abutment, is approximately 30 feet long and consists of large stone slabs set as steps on the downstream side. The two training walls are of reinforced concrete placed against an earlier dry masonry wall. There are no outlet works other than a high level power canal intake, which is no longer operable.

The dam was constructed on Mary Brown Brook, within the Quinebaug River Basin and just downstream from Bowdish Reservoir. The maximum storage capacity of Clarkville Pond is 165 acre feet and its drainage area is approximately 4.0 square miles. The dam was probably built in the mid 1700's and was raised 6 feet in 1872. It was used for generating mechanical power in the mill located immediately downstream of the dam. During the early 1900's there were some improvements made on the spillway and on the power canal. Presently it has only limited recreational and aesthetic purposes.

As a result of the visual inspection, hydrologic and hydraulic computations, and the review of limited available data regarding this facility, the dam is considered to be in POOR condition. To assure the long term performance of

this structure, several items of concern require further attention. The downstream walls have collapsed at numerous locations and the earth embankment is sloughing, particularly behind the collapsed sections. There is extensive tree and vegetative growth along the entire dam, and riprap is missing at numerous sections on the upstream slope. The spillway training walls are in an advanced state of deterioration; they have been undermined and are leaning towards the channel. The power canal is also in an advanced state of deterioration, and there is extensive seepage emerging along the entire length of the downstream toe of the dam.

The dam is classified as SMALL in size and as a HIGH hazard potential structure, in accordance with the recommended guidelines established by the Corps of Engineers.

The test flood for this dam (2,000 cfs) is one-half the Probable Maximum Flood (½ PMF). This flood has an outflow discharge equal to 2,000 cfs and will overtop the dam by 1.1 feet. The maximum top of dam outflow capacity of the spillway and headrace crest is 600 cfs, which represents approximately 30% of the test flood.

It is recommended that the owner engage the services of a registered professional engineer to alleviate the problems listed under Sections 7.2 and 7.3 and perform a detailed hydrologic-hydraulic investigation to assess further the potential of overtopping the dam and the need for and the means to increase project discharge capacity. The above recommendations should be instituted IMMEDIATELY after receipt of this report.

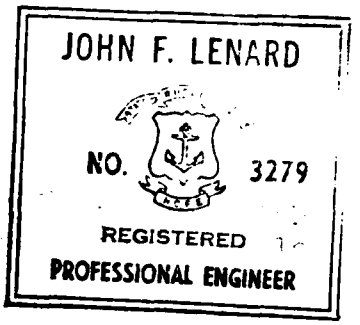
LENARD & DILAJ ENGINEERING, INC.

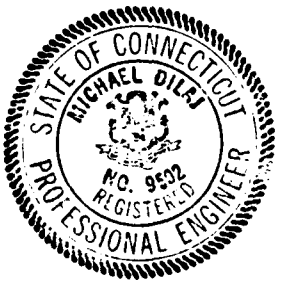
By: John F. Lenard

John F. Lenard, P.E.
President

Michael Dilaj

Michael Dilaj,P.E.,Vice President
Project Manager





This Phase I Inspection Report on Clarkville Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation. However, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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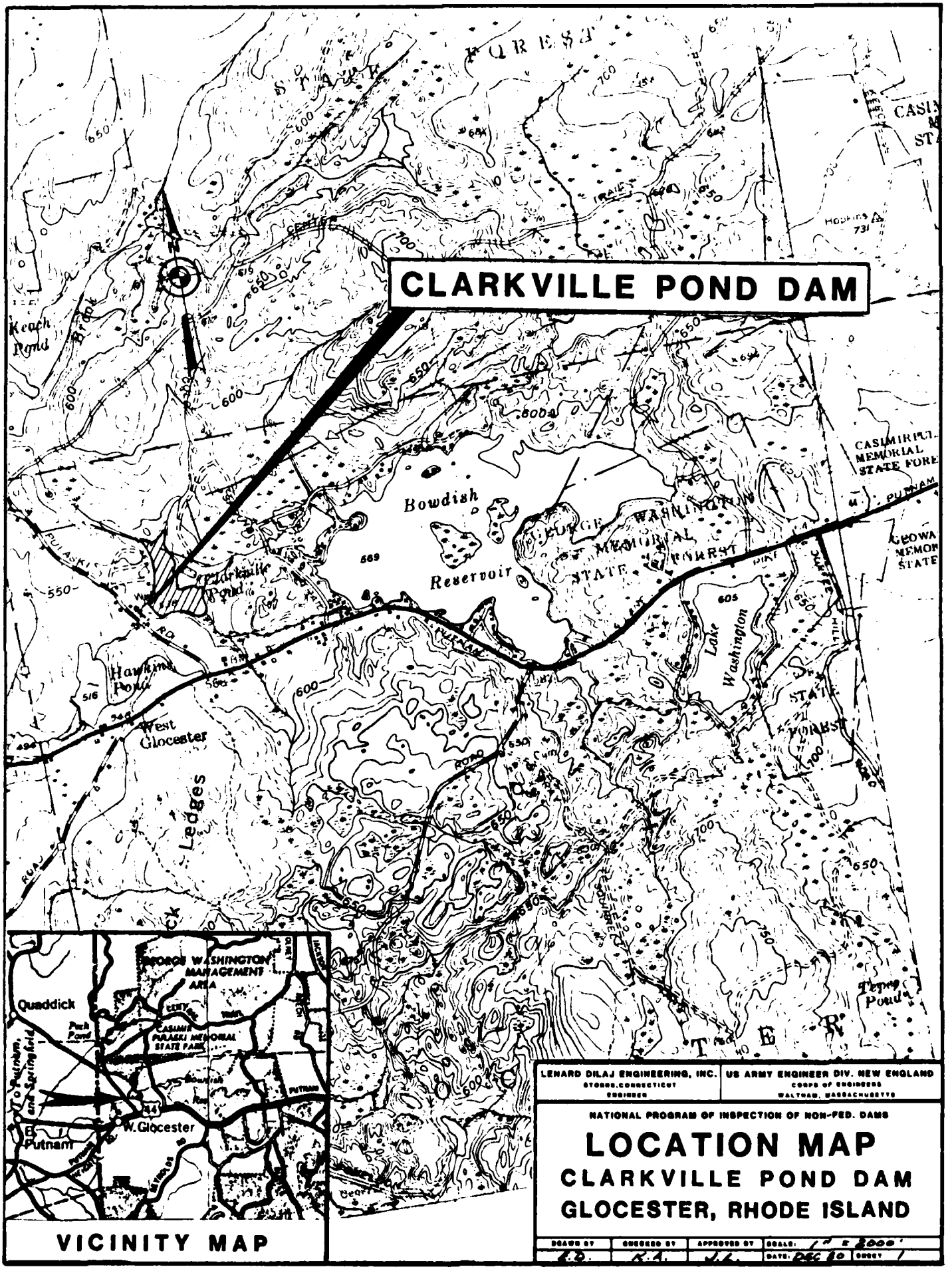

CLARKVILLE POND DAM
Keach Pond
Bowdish Reservoir
Clarkville Pond
Hawkins Pond
West Glocester
Ledges
Lake Washington
Tepee Pond
CASIMIR PULASKI MEMORIAL STATE FOREST
GEORGE WASHINGTON MEMORIAL STATE FOREST
PULASKI
PUTNAM
Quaddick
Putnam
W. Glocester
VICINITY MAP
LENARD DILAJ ENGINEERING, INC.
STORRS, CONNECTICUT
ENGINEER
US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
LOCATION MAP
CLARKVILLE POND DAM
GLOCESTER, RHODE ISLAND
DRAWN BY
CHECKED BY
APPROVED BY
SCALE: 1" = 2000'
DATE: DEC 80
SHEET 1

PHASE I INSPECTION REPORT

SECTION I - PROJECT INFORMATION

1.1 General:

a. Authority: Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Lenard & Dilaj Engineering, Inc. has been retained by the New England Division to inspect and report on selected dams in the States of Connecticut and Rhode Island. Authorization and notice to proceed were issued to Lenard & Dilaj Engineering, Inc. under a letter of 6 November, 1980 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-81-C-0014 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program: The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interest.

2. Encourage and prepare the states to quickly initiate effective dam inspection programs for non-federal dams.

3. To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program: The scope of this Phase I inspection report includes:

1. Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

2. A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

3. Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

4. An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgment on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 Description of the Project:

a. Location: The project is located on Mary Brown Brook, a tributary to the Five Mile River, which is located approximately 3 miles downstream of Clarkville Pond Dam. Mary Brown Brook and the Five Mile River are a part of the Quinebaug River Basin. The pond and dam are located in the Town of Glocester, County of Providence, and State of Rhode Island. The dam is located just 200 feet east of Pulaski Road, and is shown on the Thompson, Conn.-R.I. USGS quadrangle map, having coordinates 41° 55' 18" (north latitude) and 71° 47' 24" (west longitude).

b. Description of Dam and Appurtenances: Clarkville Pond Dam is an earth embankment, approximately 400 feet long, with 2 dry masonry stone walls on the downstream side. It has an average height of 12 feet and a crest width of approximately 12 feet. Because of the advanced state of deterioration of the walls and due to the sloughing and erosion of the upstream and downstream slopes, no definite dimensions can be given.

The stone slab spillway is located near the left abutment of the dam. It is 28 feet wide and has two 4 foot high reinforced concrete training walls, which are in an advanced state of deterioration. The stone slabs in the spillway discharge channel are laid in a step-like manner from the crest to the streambed. Rods have been provided on the crest for the insertion of flashboards. At the right abutment of the dam is a power intake canal. This intake is located in line with the dam and consists of a reinforced concrete structure with a 24 inch diameter pipe. The gate on the intake pipe is missing. The power canal leads into a penstock and then into the mill which is located approximately 200 feet downstream of the dam.

Power generation or any other water use has been discontinued for some time. Presently the reservoir serves only to have an aesthetic value and has limited recreational use.

c. Size Classification: With the pool level at the top of the dam, the dam's impoundment capacity is 165 acre feet and its maximum height is 14 feet. The dam is therefore classified as a SMALL structure in accordance with the recommended guidelines of the Corps of Engineers. Limits for such classifications are shown on page 1 of Appendix D.

d. Hazard Classification: The dam is classified as having a HIGH hazard potential because there is a mill structure located immediately downstream of the dam and a residential unit which was recently constructed within the flood plain below the dam. Flooding of these structures may cause loss of more than a few lives and extensive property damage, particularly since the mill is being converted to residential use. The estimated prefailure depth at the location of the mill building and the residential unit adjacent to the mill building is 2 feet. Estimated water depth for a possible dam failure discharge of 12,000 cfs is 8 feet at this same location.

e. Ownership: The Clarkville Pond Dam is owned by John Abbott of 192 Summit Street, Pawtucket, Rhode Island.

f. Operator: There are no operating personnel other than the dam owner, John Abbott, 192 Summit Street, Pawtucket, Rhode Island, telephone (401) 568-8287.

g. Purpose of Dam: The dam at Clarkville Pond presently has no other purpose than aesthetic value and limited recreational use.

h. Design and Construction History: The dam was originally constructed in the mid 1700's and raised 6 feet in 1872. In 1910 there were improvements made to the power canal, and the present intake structure for the power canal was probably constructed at that time. (See more details of history in Appendix.)

i. Normal Operating Procedures: There are no operating procedures at this dam. The power canal is presently closed off from the downstream end of the intake structure with a plywood sheet tied down with ropes.

1.3 Pertinent Data:

a. Drainage Area: Clarkville Pond and its drainage area are located in Providence County in the northwesterly portion of Rhode Island. The basin is generally irregular in shape with a longitudinal northeast-southwest axis of approximately 3 miles and a width of 2 miles. The total drainage area for this study has been divided into two parts, one for Bowdish Reservoir of 3.1 square miles and one for Clarkville Pond of 0.9 square miles (See Watershed Map). Because of the large amount of storage available in Bowdish Reservoir, its influence on the inflow hydrograph to Clarkville Pond, both in terms of flow and time of concentration, was considerable. Because of the limited storage areas and watersheds, two other ponds were not considered in the calculation of the inflow hydrograph. These ponds were Wilbur Pond and Lake Washington, located in the northeasterly portion and southeasterly portion of the watershed, respectively. In total, the watershed area contributing to the inflow at Clarkville Pond is 4.0 square miles.

The topography of the basin consists of generally rolling terrain, with a substantial portion taken up by wetland areas and water bodies. Elevations range from a low of 564 feet at the spillway crest of Clarkville Pond Dam to a high of 760 in the southeasterly corner of the basin. Slopes are moderate with grades ranging generally from 5% to 15%.

b. Discharge at Dam Site: No discharge records are maintained at this facility. There were no flashboards in place on the spillway crest at the time of this inspection, but the power canal was found to be closed off and inoperational. There is some limited discharge capability available over the crest of the power canal intake. Because this portion is ungated, its discharge has been included under the ungated spillway capacity. A more accurate breakdown may be found under the hydraulic calculations in Appendix D of this report.

1. Outlet works:	Inoperational (Power canal discharges into building)
2. Maximum known flood at dam site:	Discharge unknown
3. Ungated spillway capacity at top of dam:	611 cfs at Elev.542.0
4. Ungated spillway capacity at test flood elevation:	896 cfs at Elev. 543.1

5.	Gated spillway capacity at normal pool elevation:	N/A
6.	Gated spillway capacity at test flood elevation:	N/A
7.	Total spillway capacity at test flood elevation:	900 cfs at Elev. 543.1
8.	Total project discharge at top of dam:	600 cfs at Elev. 542.0
9.	Total project discharge at test flood elevation:	2,000 cfs at Elev. 543.1

c. Elevation (Feet above National Geodetic Vertical Datum):

1.	Streambed at toe of dam:	528.0
2.	Bottom of cutoff:	Unknown
3.	Maximum tailwater:	Unknown
4.	Normal pool:	538.0
5.	Full flood control pool:	N/A
6.	Spillway crest:	538.0
7.	Design surcharge (original design):	N/A
8.	Top of dam:	540.5 (varies)
9.	Test flood surcharge:	543.1

d. Reservoir (Length in Feet):

1.	Normal pool:	1,300
2.	Flood control pool:	N/A
3.	Spillway crest pool:	1,300
4.	Top of dam:	1,600
5.	Test flood pool:	1,650

e. Storage (acre-feet):

1.	Normal pool:	93
2.	Flood control pool:	N/A
3.	Spillway crest pool:	93

4.	Top of dam:	165
5.	Test flood pool:	193

f. Reservoir Surface (acres):

1.	Normal pool:	13
2.	Flood control pool:	N/A
3.	Spillway crest:	13
4.	Test flood pool:	27
5.	Top of dam:	23.5

g. Dam:

1.	Type:	Earth embankment
2.	Length:	400 feet
3.	Height:	14 feet
4.	Top width:	12 feet
5.	Side slopes:	Upstream: 2H:1V Downstream: Vertical Stone Walls w/1H:1V earth slope
6.	Zoning:	Unknown
7.	Impervious core:	Unknown
8.	Cutoff:	Unknown
9.	Grout curtain:	Unknown

h. Diversion and Regulating Tunnel: N/A

i. Spillway:

1.	Type:	Broad crest, stone masonry surface
2.	Length of weir:	27.5 feet
3.	Crest elevation (without flashboards):	538.0

4.	Gates:	None
5.	U/S channel:	Natural bed
6.	D/S channel:	Natural bed
j.	Regulating Outlets:	24-inch inlet into power canal. Since the removal of the generating equipment, the flow would flood the mill structure. Canal not operational.

SECTION 2

ENGINEERING DATA

2.1 Design: No data on the design of the dam or appurtenances has been found and probably none exist.

2.2 Construction: The original dam at Clarkville Pond was probably build in the mid 1700's. In 1872 the dam was raised 6 feet. At this time it was used for power generation. The power canal was reconstructed after 1910. The reinforced concrete construction of the intake structure and spillway walls probably dates from that period.

2.3 Operation: This dam appears to have been constructed for power generating purposes. The equipment has been disassembled and presently the pond serves only recreational and aesthetic purposes. Indications are that flashboards were used at the spillway in the past. Presently, only the iron bars originally used to hold the boards are in place at the crest of the spillway. There are no records kept at the facilities.

2.4 Evaluation:

a. Availability: There are no computations, drawings, or operational procedures available for this dam.

b. Adequacy: Since there is no design or construction information available, the information presented in this report is based principally on the visual observations of the inspection team.

c. Validity: Due to the lack of available data, the conclusions and recommendations found in this report are based on the visual inspection and hydrologic/hydraulic computations.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

a. General: An inspection of Clarkville Pond Dam was performed on 14 November 1980 by Lenard & Dilaj Engineering, Inc., with the assistance of Geotechnical Engineers, Inc. The temperature on this day was in the 30^{O}- 40^{O}F range, with clear and sunny skies. The ground was clear of snow.

As a result of the visual inspection, the dam at Clarkville Pond and its appurtenances are judged to be in POOR condition. The dam is an earth embankment with downstream walls consisting of a 2 to 3 foot high dry masonry knee wall and an 8 foot high dry masonry wall. Considerable portions of these walls are collapsed or are bulging extensively. The earth embankment behind the walls is sloughing, and there is very extensive seepage all along the downstream toe of the dam.

The spillway training walls are in a state of advanced deterioration, being undermined at the base and leaning outward. The dike forming the left bank of the power canal, as well as the concrete walls at the downstream end of the canal are also in a state of advanced deterioration.

At the time of inspection, the water level in the reservoir was at spillway crest elevation of 542 feet.

b. Dam: The dam is an earth embankment with downstream dry masonry stone walls. There is a 2 to 3 foot high knee wall and approximately 15 feet towards the reservoir, there is an approximately 8 to 10 foot high dry masonry stone wall. There are no construction or design drawings available. Records indicate that the dam was constructed in the 1700's and was raised in 1872. They also indicate that the location of the dam has not been changed and a 1910 plan shows the impoundment to be practically identical in area to today's pond.

1. Crest: The crest of the dam is very uneven in width and elevation and is covered with trees and grass. There is a foot path along the approximate

centerline of the crest (Photo 2). At its lowest point the crest is 0.6 feet lower than near the spillway. The 1 to 2 foot settlements of the crest are probably due to the collapse of the downstream stone masonry walls.

2. Upstream slope: The upstream slope (2H:1V) is partially covered with riprap (Photo 1). This cover is very uneven and the size of the riprap ranges from 6 inches to 30 inches in size. There is extensive brush and tree growth between the riprap.

3. Downstream slope: The state of advanced deterioration of the downstream slope (1H:1V) is due to the collapse of the stone walls, sloughing and erosion. Approximately within 30 feet to the right of the spillway, the wall is completely collapsed and there is extensive sloughing on the earth embankment (Photo 5). There is also a 20 inch diameter tree growing on the downstream slope in this area. Approximately 70 feet from the spillway, another section of the wall has crumbled, due probably in part to the additional pressure of a tree growing at this location. There are large voids in the wall and the earth embankment is sloughing. Another section of the wall, approximately 50 feet left of the power canal, has bulged extensively (Photo 9 and 10).

   The knee stone wall is in a state of deterioration along most of the dam. Long sections of it have completely collapsed and the slope behind it has sloughed. There is extensive tree growth also behind the knee wall. There is extensive seepage along the entire length of the toe of the dam with a typical rust-brown colored water with a surficial oil sheen (Photo 8). Because of marsh type vegetation and ponding of the water downstream of the dam, flow from seepage is not apparent. However, the seepage flow becomes noticeable at the culvert on Pulaski Road. Looking upstream from this culvert (Photo 14) one can see two converging streams. One stream on the right is coming from the spillway while the stream from the left is carrying almost as much discharge from the leakage.

c. Appurtenant structures: The appurtenant structures for this dam are the overflow spillway, and the power canal at the intake structure.

   1. Overflow spillway: The overflow spillway consists of a dry stone masonry wall built with large stone

slabs stepped down in numerous stages; it is in good condition. The training walls are of reinforced concrete placed against dry masonry walls and are in poor condition. The left training wall has been undermined and has cracked and tilted. (Photo 12). Tilting may have occurred partly as the result of pressures due to a 36 inch tree growing immediately behind this training wall. The right training wall is also undermined and cracked at numerous locations (Photo 4). The downstream part of the right training wall is of stone masonry and has partially collapsed (Photo 5). There are numerous trees growing behind the right and left training walls. Five steel bars at the spillway crest support flashboards for raising the pond elevation. These bars may cause obstruction by blocking the path of floating debris.

2. Power canal: The intake structure for the power canal is a reinforced concrete structure (Photo 7) with a 24 inch pipe. The gate is missing and flow is blocked by plywood attached with ropes on the downstream face. The concrete is cracked at numerous locations.

   The walls of the power canal near the penstock have bulged and crumbled, and are in a state of advanced deterioration. The left earth dike of the power canal has also deteriorated, is sloughing, and has partially collapsed.

d. Reservoir Area: There is considerable siltation at the spillway area in the reservoir. There are only a few houses along the shores of the reservoir. The reservoir is used for intermittent recreation by the neighboring residents.

e. Downstream Channel: The spillway of the Clarkville Pond Dam discharges into Mary Brown Brook. Approximately 300 feet downstream from the spillway the brook passes under Pulaski Road in a culvert. A considerable amount of flow enters this brook just upstream from the culvert. This additional flow emanates from seepage.

3.2 Evaluation: Based on the visual inspection, the overall condition of the dam and its appurtenances is poor.

a. Extensive tree and brush growth is on the crest of the dam, on the upstream and downstream slopes, behind the spillway training walls, and at the power canal intake.

b. The stone masonry walls have collapsed at numerous locations and the earth embankment is sloughing.

c. The spillway training walls have been undermined, have severe cracks and are leaning.

d. Riprap is missing in many areas of the upstream slope.

e. There is very extensive seepage exiting at the downstream toe along the entire length of the dam.

f. The power canal, its intake structure, and the training walls are in an advanced state of deterioration.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures:

a. General: The owner does not reside at the dam and there is no one present at the site to attend to any routine or emergency functions. There are no formal operational procedures in effect at the dam.

b. Description of any Warning System in Effect: There are no warning systems in effect at this facility.

4.2 Maintenance Procedures:

a. General: There is no maintenance at this dam as evidenced, in particular, by the growth of trees and vegetation on the embankments. Indications are that the dam and appurtenant facilities have not been maintained for at least the past decade.

b. Operating Facilities: Discharge into the power canal is blocked by a plywood board placed over the downstream side of the inlet(Photo 7).The power generating equipment is removed and,if flow would be discharged into the canal, it would spill into the mill building. The spillway training walls are crumbling and steel bars at the crest of the spillway may constrict the free passage of flow. The blockage of the power canal intake was the only evidence of activity at the facility.

4.3 Evaluation: There is no indication that the dam, spillway and appurtenant facilities are being maintained. An emergency warning system should be developed as discussed in Section 7.3 of this report.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General: Clarkville Pond Dam is an earth embankment dam with two vertical downstream stone masonry walls. The dam is about 400 feet long, 12 feet wide at the crest, and 14 feet high at the streambed. There is a stone masonry spillway 27.5 feet wide and 4 feet high which, for purposes of hydraulic calculations, was considered as a broad crested weir. Because the power generation equipment at the mill is now inoperable, the head race was not considered as an integral part of the discharge capacity of the dam. Its only contribution is to provide some additional spillway capacity at the intake structure, where the top portion would act as a weir to allow flow over the dam.

The downstream channel is approximately 15 feet wide at the base of the dam and continues at this width to the road crossing 200 feet downstream. The channel winds in this area between the dam and the road, and its banks are generally overgrown with trees and brush.

The watershed covers an area of 4.0 square miles, of which 3.1 square miles contributes to Bowdish Reservoir, which lies just upstream from Clarkville Pond. Because of the storage capacity available at Bowdish Reservoir, its effect on the flows at Clarkville Pond Dam is significant. For this reason, the flood was routed through both Bowdish Reservoir and Clarkville Pond.

At spillway elevation, Clarkville Pond has a storage capacity of 93 acre feet. This increases to 165 acre feet at the top of the dam.

5.2 Design Data: No design data was available for Clarkville Pond Dam.

5.3 Experience Data: No records on past experience were found to be available for this site.

5.4 Test Flood Analysis: Based on the "Recommended Guidelines for Safety Inspection of Dams", Clarkville Pond Dam is

classified as SMALL in size with a HIGH hazard potential. The test flood for these conditions ranges from half the Probable Maximum Flood to the Probable Maximum Flood (½ PMF to PMF). Because of the potential downstream damage involved with failure and based on the size and storage capacity of the dam, the ½ PMF was chosen as the test flood.

Using the HEC-1 Flood Hydrograph Computer Program developed by the Army Corps of Engineers for dam safety investigations, the inflow and outflow for the test flood were both found to be 2,000 cfs (500 CSM). As a basis of comparison, the PMF resulted in an inflow of 6,350 cfs and an outflow of 6,300 cfs. The outflow capacity of Clarkville Pond Dam at the top of the dam is 600 cfs, which represents 30% of the test flood outflow.

As previously mentioned, the storage in Bowdish Reservoir has a significant effect on the inflow hydrograph to Clarkville Pond. This storage was included in the analysis, as shown by the calculations in Appendix D of this report.

5.5 Dam Failure Analysis: A dam failure analysis was performed using the "Rule of Thumb" method for estimating downstream dam failure hydrographs, as developed by the Corps of Engineers. Failure was assumed to occur when the water level in the pond was at the level of the top of the dam. The spillway discharge just prior to the dam's failure would be 611 cfs, producing a depth of flow of approximately 2 feet in the vicinity of the mill and residence just downstream of the dam (See Overview Photo). The calculated dam failure discharge is 12,000 cfs, which will produce a depth of flow of approximately 8 feet at the same location. This means an increase of 6 feet in the water depth at the time of failure. The analysis covered a distance of 3,800 feet downstream, as shown by the calculations in Appendix D. The depth of flow at that point was calculated to be 4.1 feet for the dam failure.

A 40% breach measured at the mid height of the dam could cause significant downstream damage and result in the loss of more than a few lives; therefore, the dam is classified as having a HIGH hazard potential. The mill complex, now being converted for residential use and the residence just downstream of the dam would receive the greatest damage. Appreciable damage could also occur at the town road (Pulaski Road) and Route 44, about 3,000 feet downstream.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations: The visual inspection of the dam and appurtenant structures revealed a condition of deteriorating stability as indicated by the following:

a. The stone masonry walls have collapsed at numerous locations and the earth embankment is sloughing.

b. The spillway training walls have been undermined, have severe cracks and are leaning.

c. There is very extensive seepage exiting at the downstream toe along the entire length of the dam.

d. The power canal, its intake structure, and the training walls are in an advanced state of deterioration.

6.2 Design and Construction Data: There is no design and construction data available to permit a formal evaluation of the stability of the dam. The evaluation of stability is based on visual inspection. According to information obtained from residents of the area, the dam has not been overtopped over the past few decades. There are no operating records available at this location.

6.3 Post Construction Changes: The reinforced concrete structures indicate that there have been modifications since the construction of the dam. As discussed in other parts of this report, these changes took place approximately 70 years ago.

6.4 Seismic Stability: Clarkville Pond Dam is located in Seismic Zone 1 and, according to the Corps of Engineers recommended guidelines, does not require evaluation for seismic stability.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment:

a. Condition: The visual inspection indicated that the Clarkville Pond Dam is in poor condition. The major concerns regarding the future performance of this dam include:

1. Extensive tree and bush growth at every location on the dam, near the spillway training walls and the power canal intake structure.

2. The downstream stone walls have collapsed at numerous locations.

3. The earth embankment is sloughing at numerous locations, particularly behind collapsed sections of the downstream walls.

4. Riprap is missing at several locations on the upstream slope of the dam.

5. The spillway training walls are in an advanced state of deterioration; they are undermined and leaning towards the channel.

6. Vertical steel bars used to support flashboards in the spillway may obstruct the flow during flood periods. These bars should be removed.

7. The power canal intake structure and the canal itself are in an advanced state of deterioration. The gate is missing at the intake structure.

8. There is extensive seepage emerging at the downstream toe along the entire length of the dam.

9. Based on hydraulic calculations, the spillway capacity at the top of the dam is 600 cfs, representing only about 30% of the test flood flow of 2,000 cfs.

b. Adequacy of Information: The lack of in-depth engineering data did not allow for a definitive review.

Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data; it is based primarily on visual inspection and sound engineering judgment.

c. Urgency: The recommendations and remedial measures described below should be implemented by the owner IMMEDIATELY after receipt of this Phase I inspection report.

7.2 Recommendations: The owner should engage the services of a professional registered engineer experienced in the design of earth dams to accomplish the following:

a. Perform a detailed hydrologic-hydraulic investigation to assess further the potential of overtopping the dam and the need for and the means to increase project discharge capacity.

b. Assess the need for and means to provide a low level regulating outlet that would allow drawdown of the pool.

c. Engineering plans are required for the reconstruction of the downstream section of the dam. Plans should include all construction details for the proper restoration of the stone wall and the earth embankment behind the stone wall or, alternatively, for construction of a downstream section of compacted earth. Installation of filter or drainage layers may be necessary for both alternative repairs. The crest elevation of the dam should be restored to an even grade.

d. Trees and brush growing on the entire dam and appurtenant structures should be cut. The stumps and root systems of trees should be removed and holes should be backfilled with an appropriately compacted soil. In addition, a 30 foot peripheral area downstream of the toe of the dam should be cleared.

e. Investigate seepage along the toe of the dam and consider the installation of toe drains along the entire downstream toe of the dam. Discharge from these toe drains should be monitored and recorded.

f. The spillway training walls should be reconstructed. The deteriorated concrete walls must be removed and new walls should be erected according to plans prepared by an engineer.

g. The power canal intake structure should be reconstructed or removed and properly filled.

h. The riprap protection along the upstream face of the dam embankment should be re-established.

i. A topographic survey of the dam and its appurtenances should be made that will result in drawings of the existing facility to be used as a basis for the construction plans.

7.3 Remedial Measures:

a. Operating and Maintenance Procedures:

1. After removal of trees and brush in accordance with 7.2d, grass should be planted and periodically cut in these disturbed areas to protect the embankment from erosion.

2. Emergency procedures consisting of an operations plan and warning system for downstream residences should be developed and implemented. During intense rainfall the dam should be continuously monitored.

3. Technical inspection of this facility should be made on an annual basis by a qualified registered professional engineer.

4. Develop a system for recording of data such as water levels, discharges, and drawdown, to assist those responsible for monitoring the operation of the structure.

5. Remove steel flashboard support bars from spillway.

6. Remove the plywood stop from the intake pipe and replace it with an operational gate.

7.4 Alternatives: As an alternative to the above recommendations and remedial measures, the Owner should consider removing the dam.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT *CLARKVILLE POND DAM* DATE *November 14, 1980*

TIME *1:00 P.M.*

WEATHER *Cloudy, balmy*

W.S. ELEV. *At Spillway* U.S. ____ DN.S.

PARTY:

1. *Gonzalo Castro, G.E.I.*
2. *John Lenard, L.D.E.I.*
3. *Michael Dilaj, L.D.E.I.*
4. *Eric Ohlund, L.D.E.I.*
5. *Gregory Blessing, L.D.E.I.*
6. *Kent Healy, L.D.F.I.*
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	*Hydraulics*	*Michael Dilaj*	
2.	*Structural*	*John Lenard*	
3.	*Geotechnical*	*Gonzalo Castro*	
4.	*Geotechnical*	*Kent Healy*	
5.	*Survey*	*Eric Ohlund*	
6.	*Survey*	*Gregory Blessing*	
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECKLIST

PROJECT *CLARKVILLE POND DAM* DATE *November 14, 1980*

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	*None observed*
Pavement Condition	*Not applicable*
Movement or Settlement of Crest	*Severe sloughing of downstream part of crest.*
Lateral Movement	*Collapsed downstream wall*
Vertical Alignment	*Crest is irregular.*
Horizontal Alignment	*Too irregular to judge*
Condition at Abutment	*Fair*
Indications of Movement of Structural Items on Slopes	*Not applicable*
Trespassing on Slopes	*Foot paths on slopes and crest*
Sloughing or Erosion of Slopes	*Severe sloughing downstream slope due to wall collapse*
Rock Slope Protection - Riprap Failures	*No slope protection, scattered boulders*
Unusual Movement or Cracking at or Near Toe	*Knee wall in a state of collapse*
Embankment or Downstream Seepage	*Extensive seepage downstream of dam starting at toe*
Piping or Boils	*None observed*
Foundation Drainage Features	*None known*
Toe Drains	*None known*
Instrumentation System	*None known*
Vegetation	*Heavy tree and brush cover. Tree sizes up to 30" in diameter.*

PERIODIC INSPECTION CHECKLIST

PROJECT *CLARKVILLE POND DAM* DATE *November 14, 1980*

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DIKE EMBANKMENT *(POWER CANAL DIKE)*	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	*None observed*
Pavement Condition	*Not applicable*
Movement or Settlement of Crest	*Sloughing because of stone wall failure*
Lateral Movement	*Collapsed*
Vertical Alignment	*Too irregular to judge*
Horizontal Alignment	*Too irregular to judge*
Condition at Abutment and at Concrete Structures	*Fair*
Indications of Movement of Structural Items on Slopes	*Not applicable*
Trespassing on Slopes	*Several footpaths*
Sloughing or Erosion of Slopes or Abutments	*Severe sloughing of slopes*
Rock Slope Protection - Riprap Failures	*Not applicable*
Unusual Movement or Cracking at or Near Toes	*None observed*
Unusual Embankment or Downstream Seepage	*Not applicable*
Piping or Boils	*Not applicable*
Foundation Drainage Features	*Not applicable*
Toe Drains	*Not applicable*
Instrumentation System	*Not applicable*
Vegetation	*Heavy tree and brush cover*

PERIODIC INSPECTION CHECKLIST

PROJECT *CLARKVILLE POND DAM* DATE *November 14, 1980*

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	*No approach channel*
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	*Poor, cracked, spalling*
Condition of Concrete	
Stop Logs and Slots	*None*
	Makeshift gate on intake pipe, downstream end.

PERIODIC INSPECTION CHECKLIST

PROJECT *CLARKVILLE POND DAM* DATE *November 14, 1980*

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	*None*
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

PERIODIC INSPECTION CHECKLIST

PROJECT *CLARKVILLE POND DAM* DATE *November 14, 1980*

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	*There is no conduit at this facility.*
General Condition of Concrete	*(See next page)*
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECKLIST

PROJECT *CLARKVILLE POND DAM* DATE *November 14, 1980*

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	*Power house inlet channel*
General Condition of Concrete	*Poor*
Rust or Staining	*Rusty*
Spalling	*Severe, numerous cracks*
Erosion or Cavitation	*Not applicable*
Visible Reinforcing	*Yes, near entrance to covered conduit*
Any Seepage or Efflorescence	*Not applicable*
Condition at Joints	*Not applicable*
Drain holes	*None in the concrete section*
Channel	*Poor condition, collapsed stone walls*
Loose Rock or Trees Overhanging Channel	*Many trees overhanging channel*
Condition of Discharge Channel	*Poor*

PERIODIC INSPECTION CHECKLIST

PROJECT *CLARKVILLE POND DAM* DATE *November 14, 1980*

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	*None*
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	*Poor, advanced state of undermining of training walls*
Rust or Staining	*None observed*
Spalling	*Yes, severe*
Any Visible Reinforcing	*No*
Any Seepage or Efflorescence	*Not observable, water going over spillway*
Drain Holes	*None observed*
c. Discharge Channel	
General Condition	*Fair*
Loose Rock Overhanging Channel	*None*
Trees Overhanging Channel	*Numerous*
Floor of Channel	*Irregular, boulders and stones rolled into channel*
Other Obstructions	*None*
Other Comments	*Reinforcing bars on spillway for steps represent potential obstruction to flow.*

PERIODIC INSPECTION CHECKLIST

PROJECT *CLARKVILLE POND DAM* DATE *November 14, 19[illegible]*

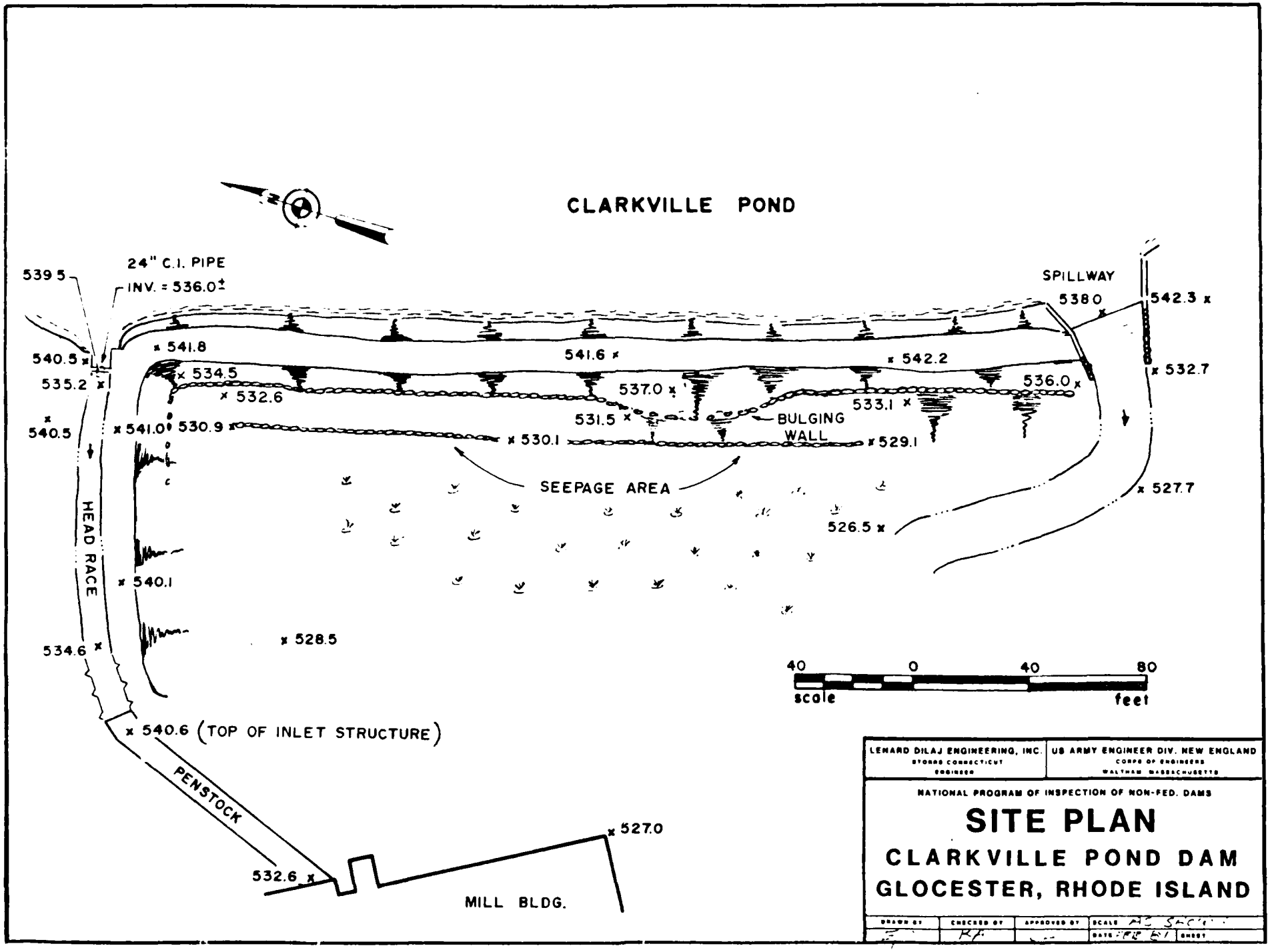
PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	*There is no service bridge at this facility.*
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Underside of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B

ENGINEERING DATA



LEMARD DILAJ ENGINEERING, INC. STORRS CONNECTICUT ENGINEER	US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM MASSACHUSETTS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SITE PLAN

CLARKVILLE POND DAM
GLOCESTER, RHODE ISLAND

DRAWN BY	CHECKED BY	APPROVED BY	SCALE 1" = 50'
	RF		DATE FEB 81 SHEET

HISTORY OF CLARKVILLE POND DAM

The first dam at Clarkville Pond was probably built in the mid 1700's. The earliest reference to a Clarkville dam was that in "1818 a mill at Clarkville was built by the Arnold Brothers."[1] In the 1800's the Clarkville Pond was called Bowdish or Bowditch Mill Pond.

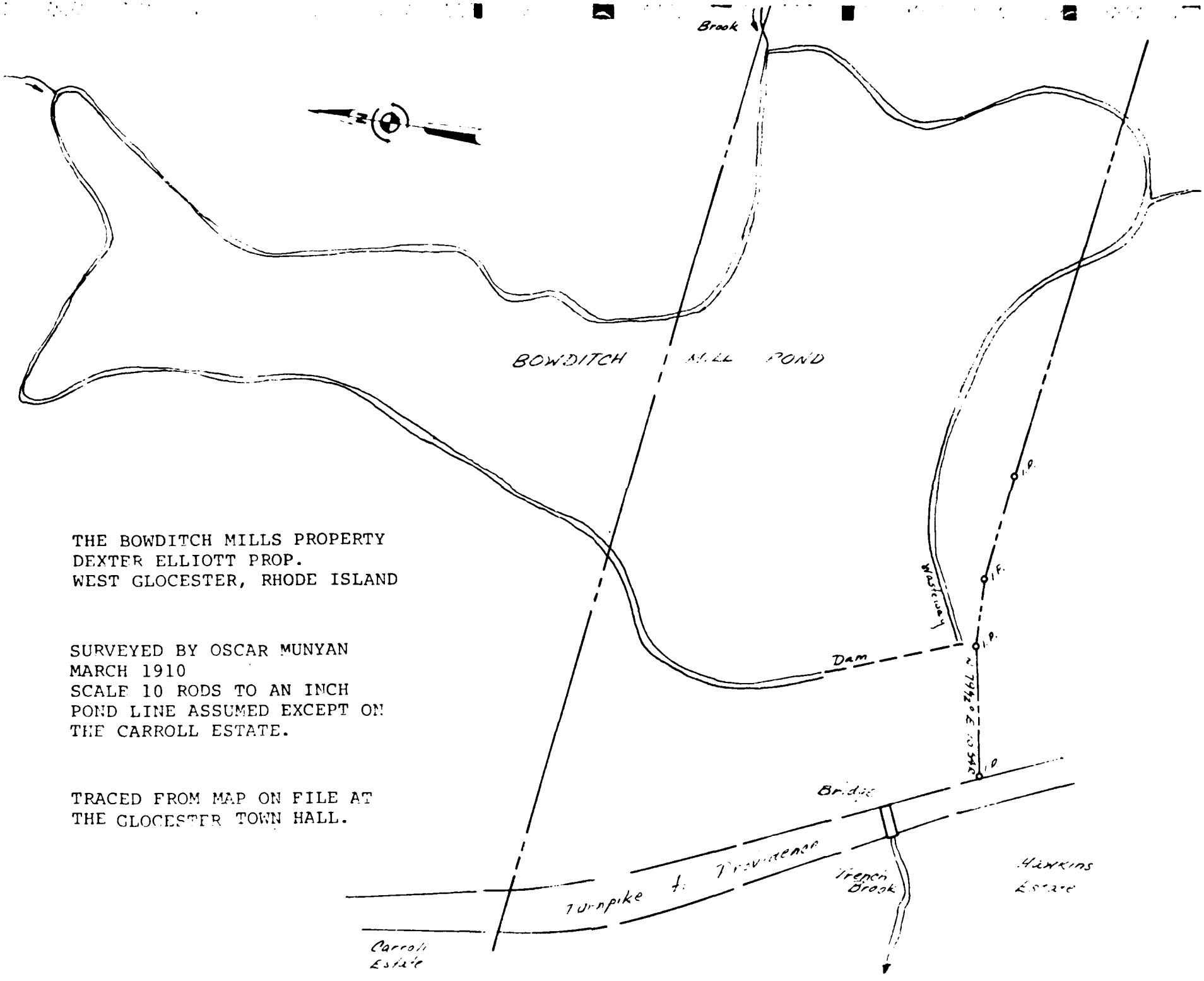
According to the Glocester land records, on April 1, 1872 the dam was to be raised six feet.[2] The owners of the dam and mill at that time, F.R. White and Company, came to an agreement with four other downstream mill owners to share the expenses of raising and maintaining the dam. F.R. White and Company wanted to increase its draw of water to a maximum of 30 horsepower or 24 feet of head. The 30 horsepower draw of water was to be tried for 3 years provided the pond could replenish itself; keeping an adequate outflow for the downstream mills.

A 1910 map of the Bowditch Mill Pond (Clarkville Pond) delineates the pond boundaries, which are similar to those of today (see map). The raceway at the north end of the dam was probably constructed between 1910 and 1930.

A recent owner of the mill property, Erich Schmidt, recalls that the dam was not overtopped due to the hurricanes of 1938 or 1955. The 1938 storm flow was "easily" handled by the two spillways. The mill property and dam are presently owned by John Abbott.

[1]Richmond Kent, The History of Chepatchet

[2]Glocester Land Records, Volume 31, pages 34-35



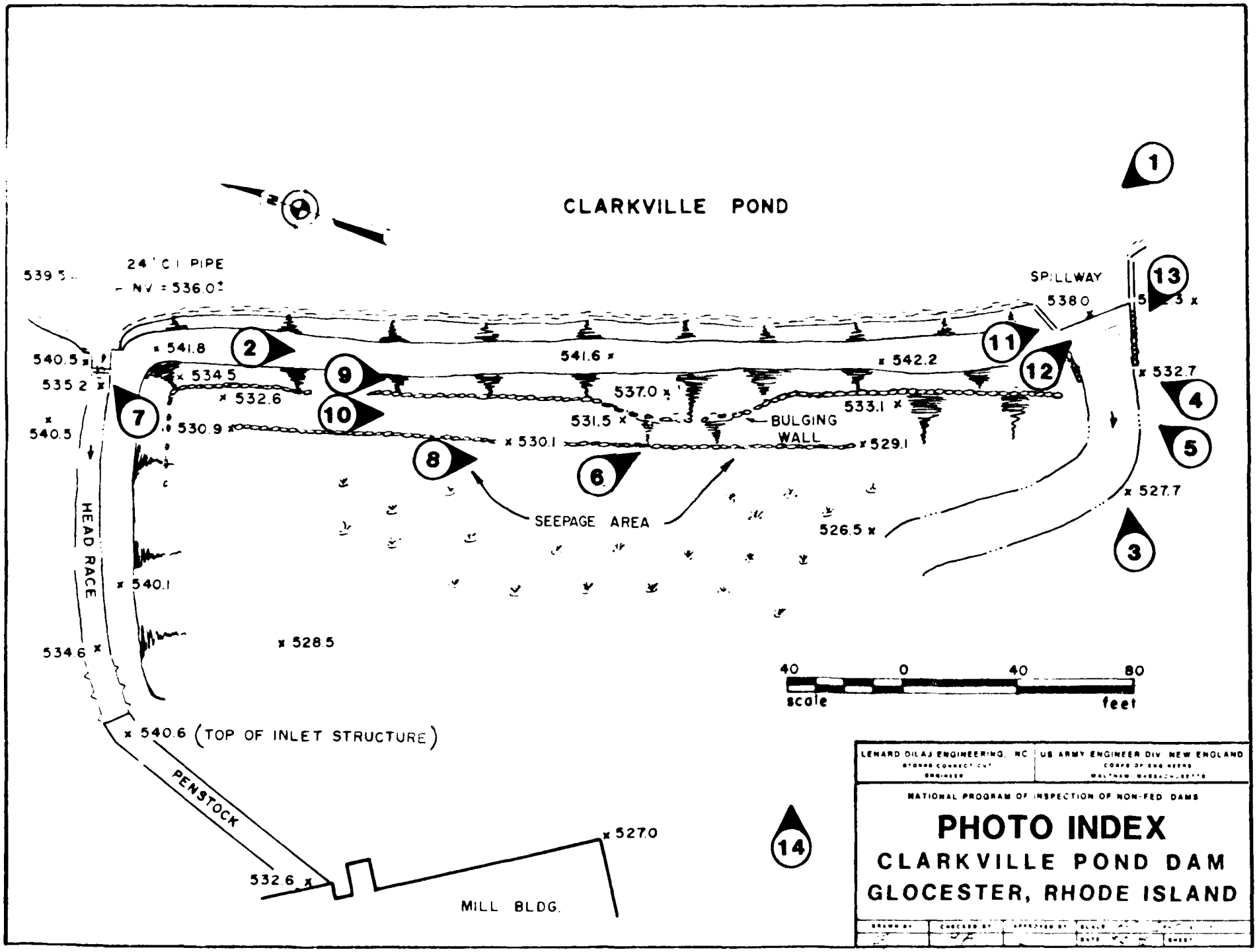
THE BOWDITCH MILLS PROPERTY
DEXTER ELLIOTT PROP.
WEST GLOCESTER, RHODE ISLAND

SURVEYED BY OSCAR MUNYAN
MARCH 1910
SCALE 10 RODS TO AN INCH
POND LINE ASSUMED EXCEPT ON
THE CARROLL ESTATE.

TRACED FROM MAP ON FILE AT
THE GLOCESTER TOWN HALL.

APPENDIX C

PHOTOGRAPHS



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STORRS CONNECTICUT
ENGINEER

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CORPS OF ENGINEERS
WALTHAM MASSACHUSETTS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

PHOTO INDEX

CLARKVILLE POND DAM
GLOCESTER, RHODE ISLAND

DRAWN BY	CHECKED BY	APPROVED BY	SCALE	SHEET
			DATE	

Photo 1. Overall view of dam from left abutment. Note spillway training wall at left, extensive tree growth on dam, and irregular riprap on upstream slope. Note faint outline of white mill structure in background.

Photo 2. View of dam crest from right abutment towards left abutment. Note sloughing on downstream slope at right of picture due to collapse of downstream stone wall, extensive tree growth on crest of dam, and footpath.

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WALTHAM MASSACHUSETTS

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NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

CLARKVILLE POND DAM
GLOCESTER, RHODE ISLAND
RI 01309
JAN. 1981
C-2

Photo 3. Downstream face of spillway. Note steel bars on crest for batter boards.

Photo 4. Right training wall of spillway. Note undermining in reinforced concrete wall and steel bars on crest of spillway.

Photo 5. Right side of spillway looking towards dam embankment. Note sloughing and collapsed sections of downstream stone wall of dam.

Photo 6. Downstream stone wall near right abutment of dam. Note collapsed stone wall and tree growing behind wall.

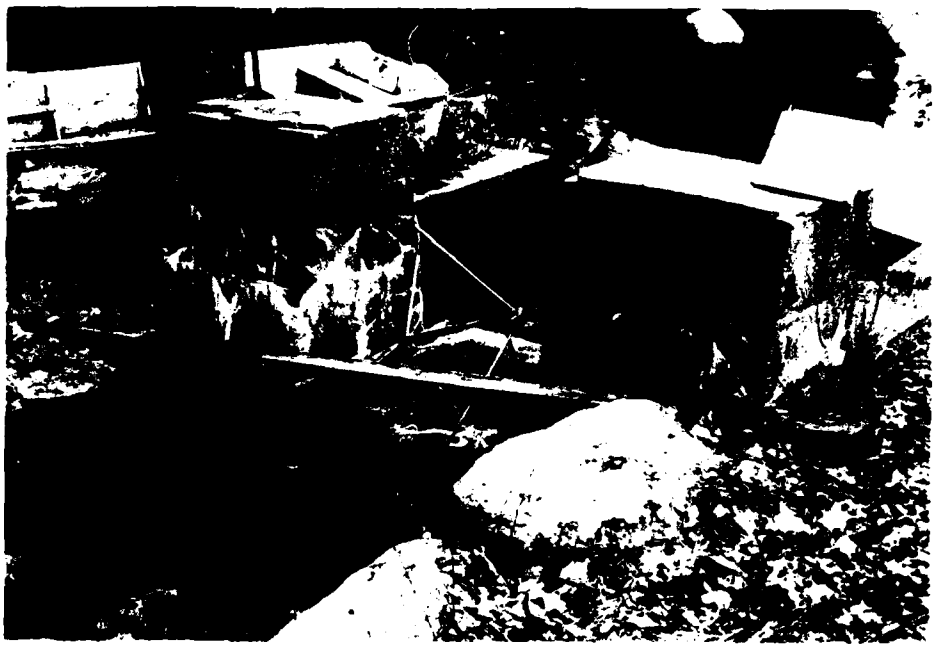


Photo 7

Intake structure for power canal. Note makeshift "gate" installed on downstream side of intake pipe and cracked concrete.

Photo 8

Section of knee wall on downstream side of dam. Note seepage at toe of wall.

Photo 9

Bulging section of downstream stone wall with tree growing on top of embankment.

Photo 10

Same stone wall viewed from downstream side. Note large openings between stones.

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS LENARD DILAJ ENGINEERING, INC. STORRS, CONNECTICUT ENGINEER	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	CLAPKVILLE POND DAM GLOCESTER, RHODE ISLAND RI 01309 JAN. 198 C-6

Photo 11

Left training wall of spillway. Note cracked sections and undermining of reinforced concrete portion of wall.

Photo 12

Close up view of Photo 11. Note the vertical outward tilting of the reinforced concrete training wall.

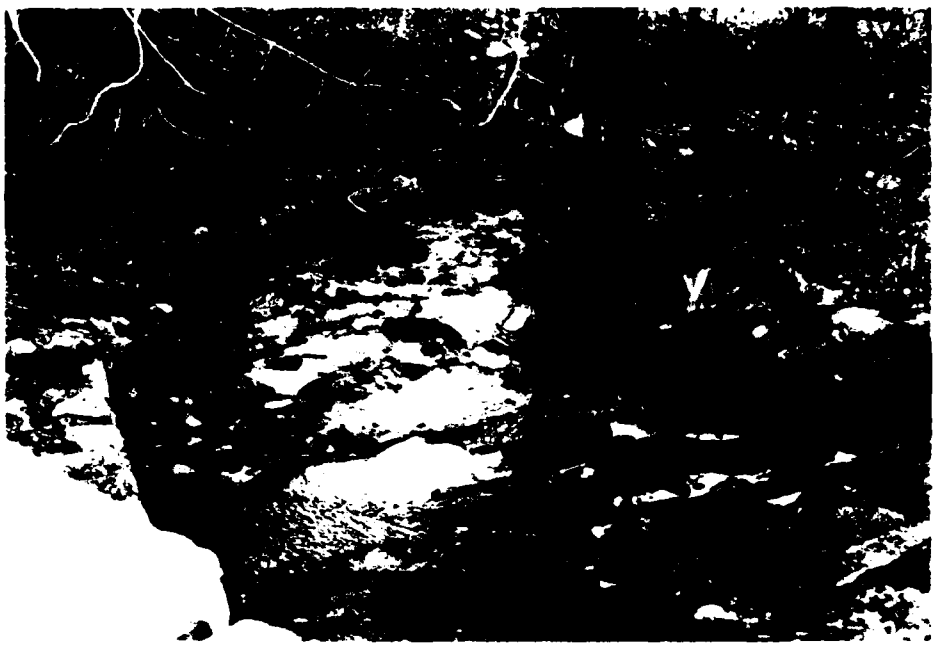


Photo 13. Downstream spillway channel.

Photo 14. Stream as observed from Pulaski Road crossing. Flow from the spillway is at the right of the photo, while a stream carrying seepage flow is at the left. Note the color of the seepage flow.

APPENDIX D

HYDROLOGIC AND HYDRAULIC

COMPUTATIONS

LENARD & DILAJ ENGINEERING, INC.
1066 Storrs Road
STORRS, CONNECTICUT 06268
(203) 429-7308

JOB Contract No. DACW33-81-C-0014
SHEET NO ____ OF ____
CALCULATED BY K. A. DATE 2/13/81
CHECKED BY ____ DATE ____
SCALE None

CLARKVILLE POND DAM

DETERMINATION OF SPILLWAY TEST FLOOD*

A. SIZE CLASSIFICATION

Based on either storage or height

			THIS DAM:
(Small)	Storage	50-999 Ac.-Ft.	165 Ac. Ft.
	Height	25-39 Ft.	14 FT.
Intermediate	Storage	1,000-50,000 Ac.Ft.	
	Height	40-100 Ft.	
Large	Storage	More than 50,000 Ac.-Ft.	
	Height	Greater than 100 Ft.	

B. HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life	Economic Loss
Low	None expected	Minimal
Significant	Few	(Appreciable)
(High)	(More than few)	Excessive

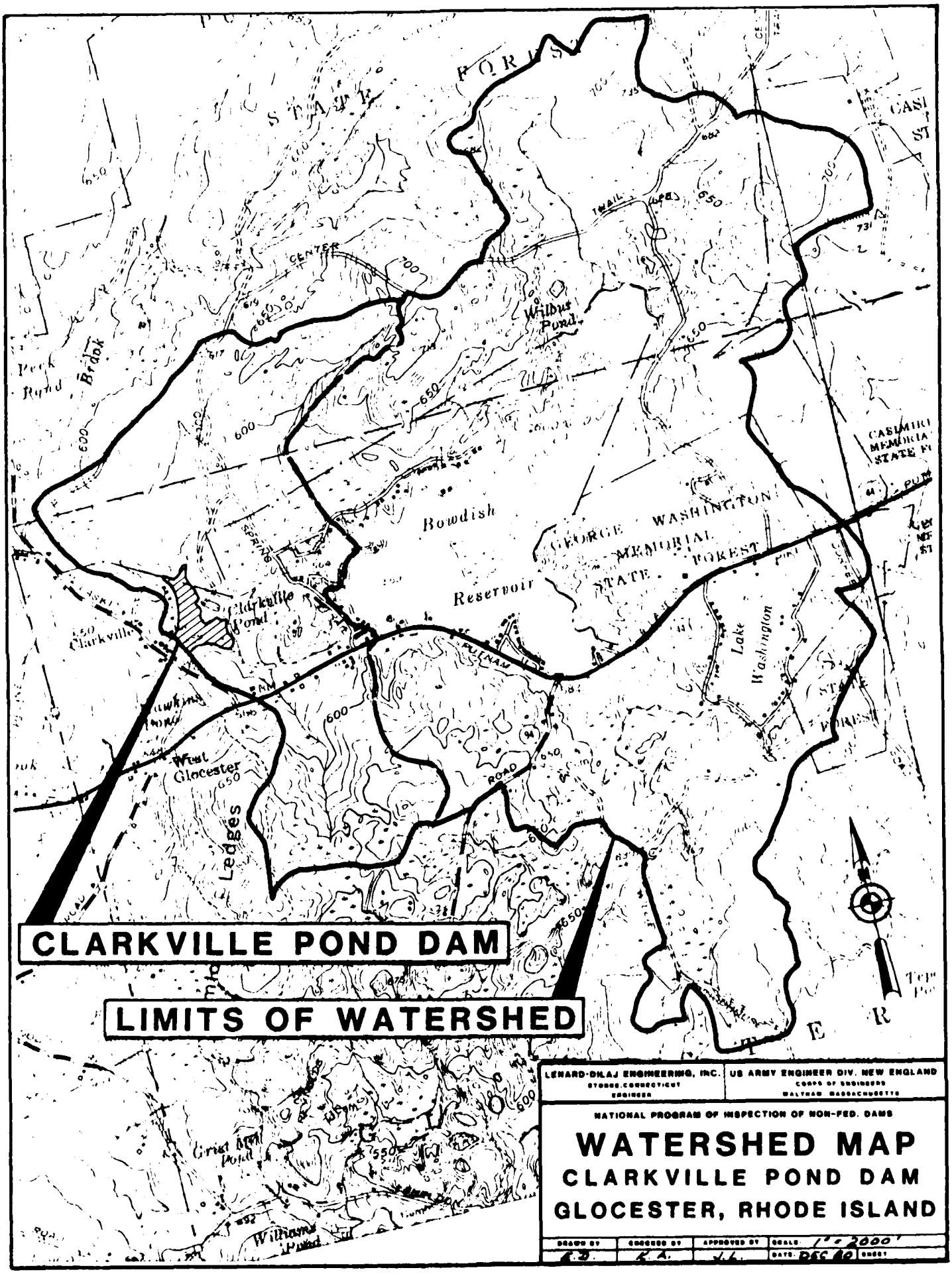
Hazard Classification HIGH

C. HYDROLOGIC EVALUATION GUIDELINES

Hazard	Size	Spillway Test Flood
Low	Small	50 to 100-Year Frequency
	Intermediate	100-Year Frequency to ½ PMF
	Large	½ PMF to PMF
Significant	Small	100-Year Frequency to ½ PMF
	Intermediate	½ PMF to PMF
	Large	PMF
(High)	(Small)	(½ PMF to PMF)
	Intermediate	PMF
	Large	PMF

Spillway Test Flood ½ PMF

* Based upon "Recommended Guidelines for Safety Inspection of Dams" Department of the Army, Office of the Chief of Engineers, November 1976.



LENARD-DILAJ ENGINEERING, INC.
STORRS, CONNECTICUT
ENGINEER

US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

WATERSHED MAP
CLARKVILLE POND DAM
GLOCESTER, RHODE ISLAND

DRAWN BY	CHECKED BY	APPROVED BY	SCALE
E.D.	R.L.	J.L.	1" = 2000'
			DATE: DEC 80 SHEET

```
••••••••••••••••••••••••••••••••
U.S. HYDROGRAPH PACKAGE (HEC-1)
AM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  24 FEB 79
••••••••••••••••••••••••••••••••

RUN DATED 02/05/81.
     TIME 14.54.54.
```

CLARKVILLE POND DAM GLOCESTER RHODE ISLAND
80-27-8
JANUARY 1981 DESIGN STORM---- **1/2 PMF**

JOB SPECIFICATION

	NHR	NMIN	IDAY	IHR	IMIN	METRIC	IPLT	IPRT	NSTAN
IT=	6	30	0	0	0	0	0	4	0
			JOPER	NRT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1
RTIOS= .10 .20 .30 .50 .80 1.00

•••••••••• •••••••••• •••••••••• •••••••••• ••••••••••

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH TO BRODISH RESERVOIR

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	1	0	0	0	1	0	1	0	0

HYDROGRAPH DATA

IHYD	ICOD	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISAME	LOCAL
1	1	3.11	0.00	3.11	0.00	0.000	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.60	24.50	100.00	111.00	120.00	127.00	0.00	0.00

THE PRECIPITATION ADJUSTMENT FACTOR USED BY THE PROGRAM IS .800

LOSS DATA

LOSS	STRTL	CNSTL	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
2	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.20	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 2.18 CP= .63 NTA= 0

RECESSION DATA
STRTQ= -1.80 QRCSN= -.05 RTIOR= 1.00

UNIT HYDROGRAPH 24 END-OF-PERIOD ORDINATES, LAG= 2.18 HOURS, CP= .62 VOL= 1.00

54.	195.	374.	514.	588.	607.	397.	309.	241.	188.
146.	114.	89.	69.	54.	42.	33.	25.	20.	15.
12.	9.	7.	6.						

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 24.89 19.37 5.52 95419.
(632.)(492.)(140.)(2701.97)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTED FLOWS THROUGH BOWDISH RESERVOIR DAM AND SPILLWAY

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	2	0	1	0	0

ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-569.	-1

STAGE	569.00	570.00	571.00	572.00	574.00	576.00	578.00	580.00	
FLOW	0.00	61.00	178.00	337.00	724.00	1200.00	1750.00	2364.00	
SURFACE AREA=	210.	242.	248.	254.	258.	263.	267.	275.	284.	289.
CAPACITY=	0.	226.	716.	1214.	1730.	2251.	2781.	3865.	4983.	5556.
ELEVATION=	569.	570.	572.	574.	576.	578.	580.	584.	588.	590.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
569.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
572.0	2.5	1.5	271.

•OVK•

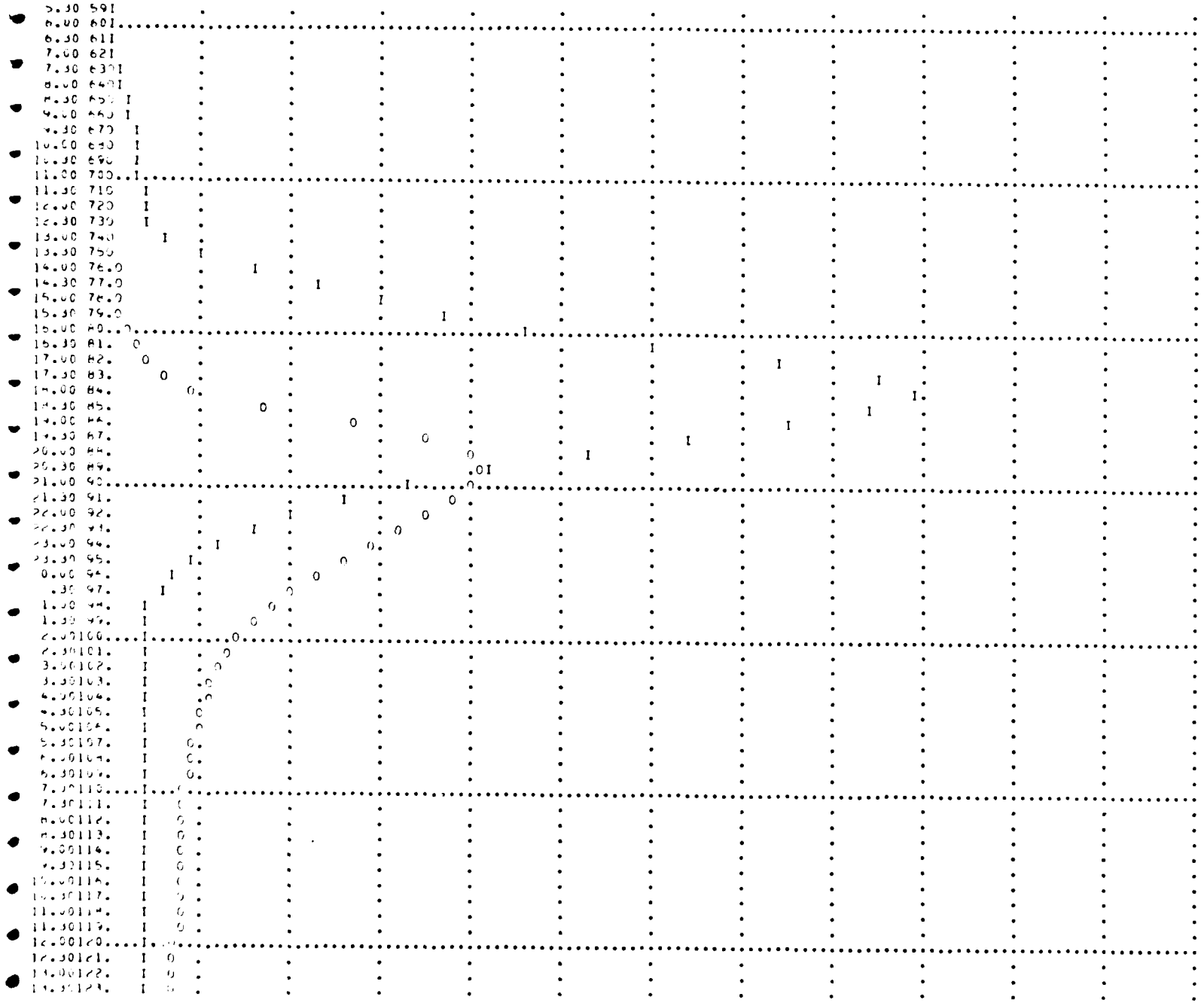
PEAK OUTFLOW IS 1645. AT TIME 44.50 HOURS

OVF

STATION 2

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	0.	400.	800.	1200.	1600.	2000.	2400.	2800.	3200.	3600.	0.	0.	0.
.30	1I												
1.00	2I												
1.30	3I												
2.00	4I												
2.30	5I												
3.00	6I												
3.30	7I												
4.00	8I												
4.30	9I												
5.00	10I												
5.30	11I												
6.00	12I												
6.30	13I												
7.00	14I												
7.30	15I												
8.00	16I												
8.30	17I												
9.00	18I												
9.30	19I												
10.00	20I												
10.30	21I												
11.00	22I												
11.30	23I												
12.00	24I												
12.30	25I												
13.00	26I												
13.30	27I												
14.00	28I												
14.30	29I												
15.00	30I												
15.30	31I												
16.00	32I												
16.30	33I												
17.00	34I												
17.30	35I												
18.00	36I												
18.30	37I												
19.00	38I												
19.30	39I												
20.00	40I												
20.30	41I												
21.00	42I												
21.30	43I												
22.00	44I												
22.30	45I												
23.00	46I												
23.30	47I												
0.00	48I												
.30	49I												
1.00	50I												
1.30	51I												
2.00	52I												
2.30	53I												
3.00	54I												
3.30	55I												
4.00	56I												
4.30	57I												
5.00	58I												



OVM

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH TO CLARKVILLE POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	0	0	0	1	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.92	0.00	.92	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.50	100.00	111.00	120.00	127.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.20	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.59 CP= .63 NTA= 0

RECESSION DATA

STRTQ= -1.80 QRCSN= -.05 RTIOR= 1.00

UNIT HYDROGRAPH 17 END-OF-PERIOD ORDINATES, LAG= 1.60 HOURS, CP= .63 VOL= 1.00

33. 114. 201. 226. 185. 129. 90. 62. 43. 30.
21. 15. 10. 7. 5. 3. 2.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	24.89	19.37	5.52	29830.
										(632.)	(492.)	(140.)	(844.69)

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS 2 AND 3 INFLOW TO CLARKVILLE POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	2	0	0	1	0	1	0	0

HYDROGRAPH ROUTING

COMBINED INFLOW ROUTED THROUGH CLARKVILLE POND DAM AND SPILLWAY

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	1	0	0	4	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-538.	-1

STAGE	538.00	539.00	539.50	540.00	542.00	544.00	546.00	548.00	550.00
FLOW	0.00	72.00	131.00	205.00	611.00	1161.00	1809.00	2547.00	3365.00
SURFACE AREA=	13.	18.	24.	30.	36.	43.	51.		
CAPACITY=	0.	31.	72.	125.	190.	268.	362.		
ELEVATION=	538.	540.	542.	544.	546.	548.	550.		

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
538.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

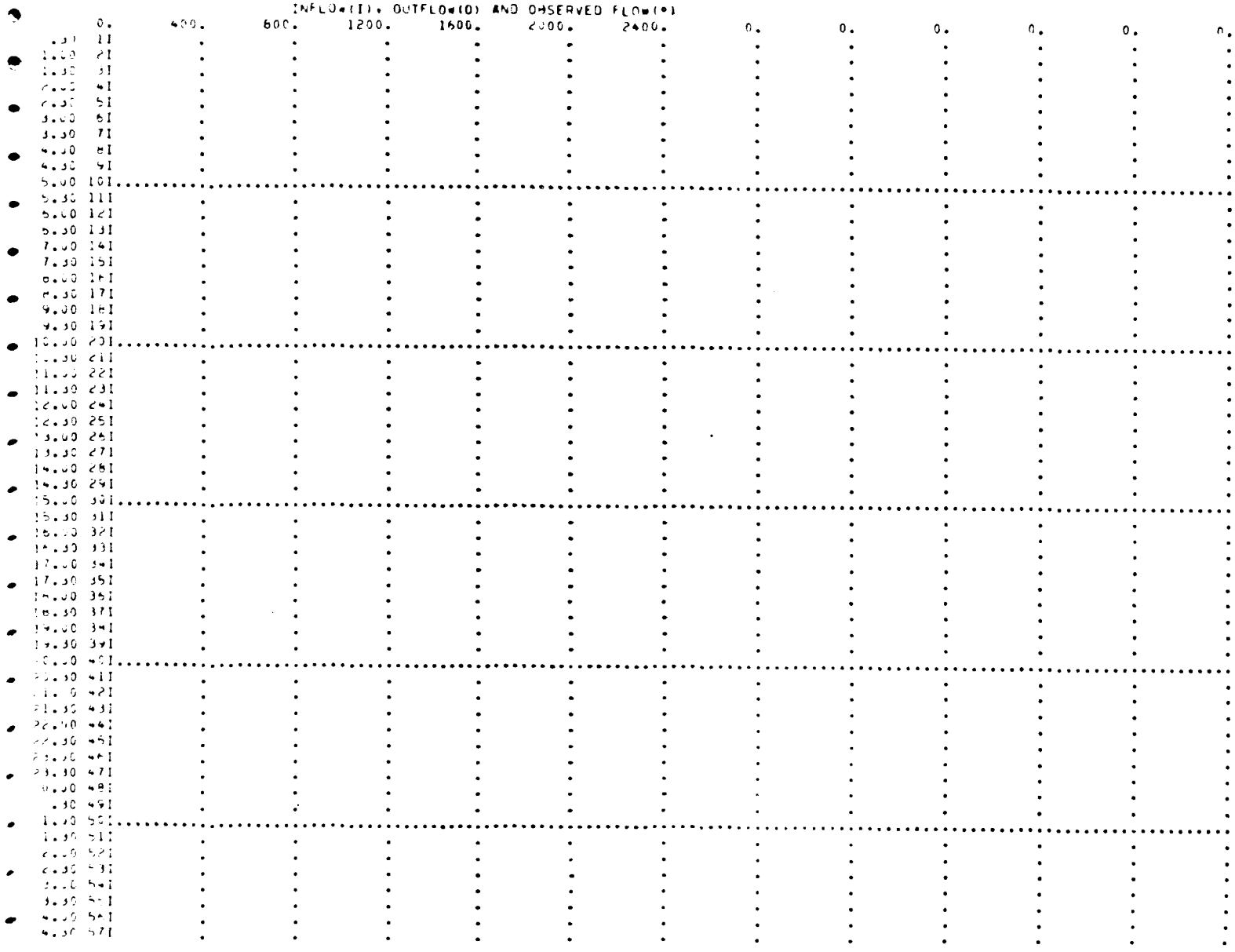
DAM DATA

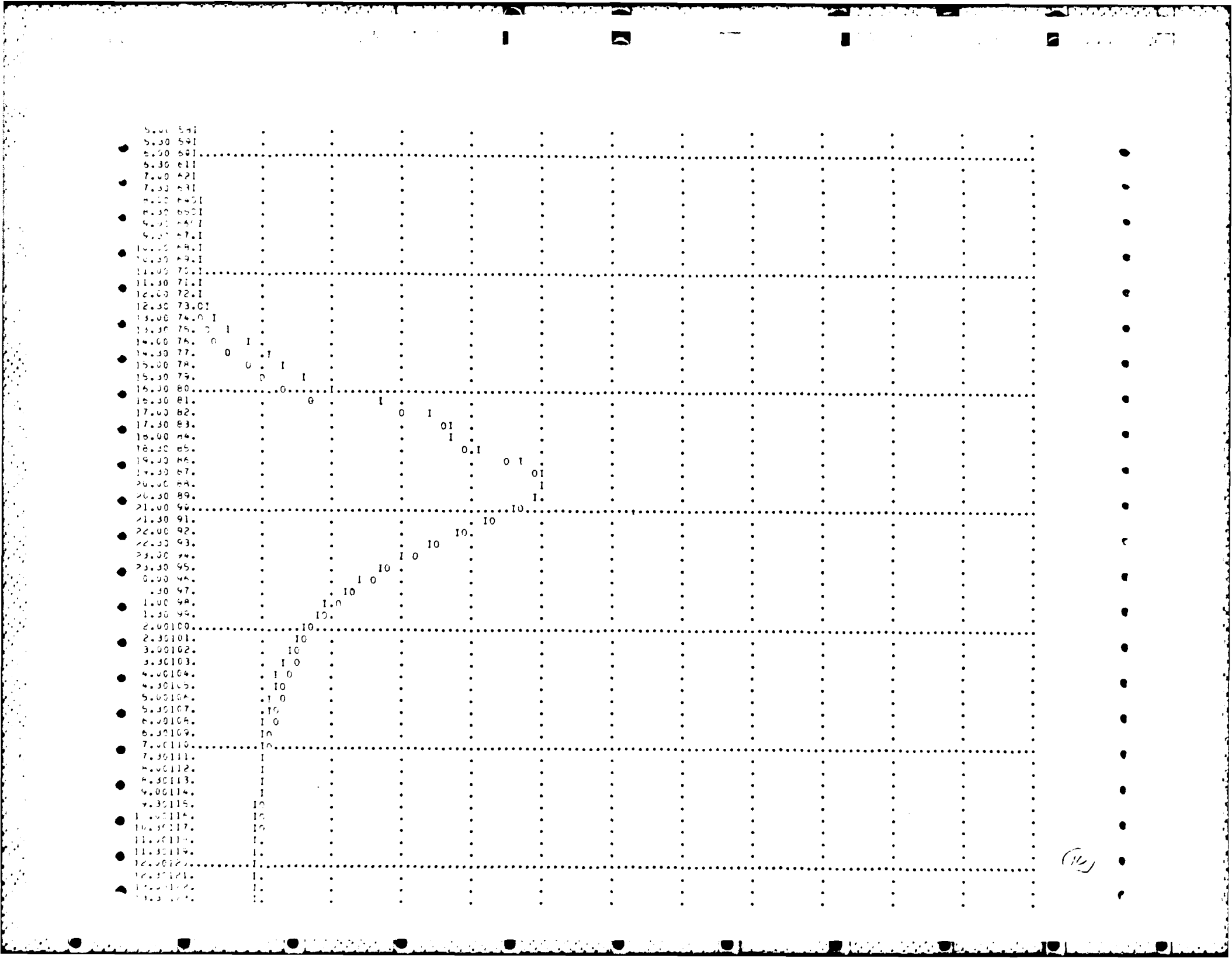
TOPEL	COQD	EXPD	DAMWID
542.0	2.5	1.5	382.

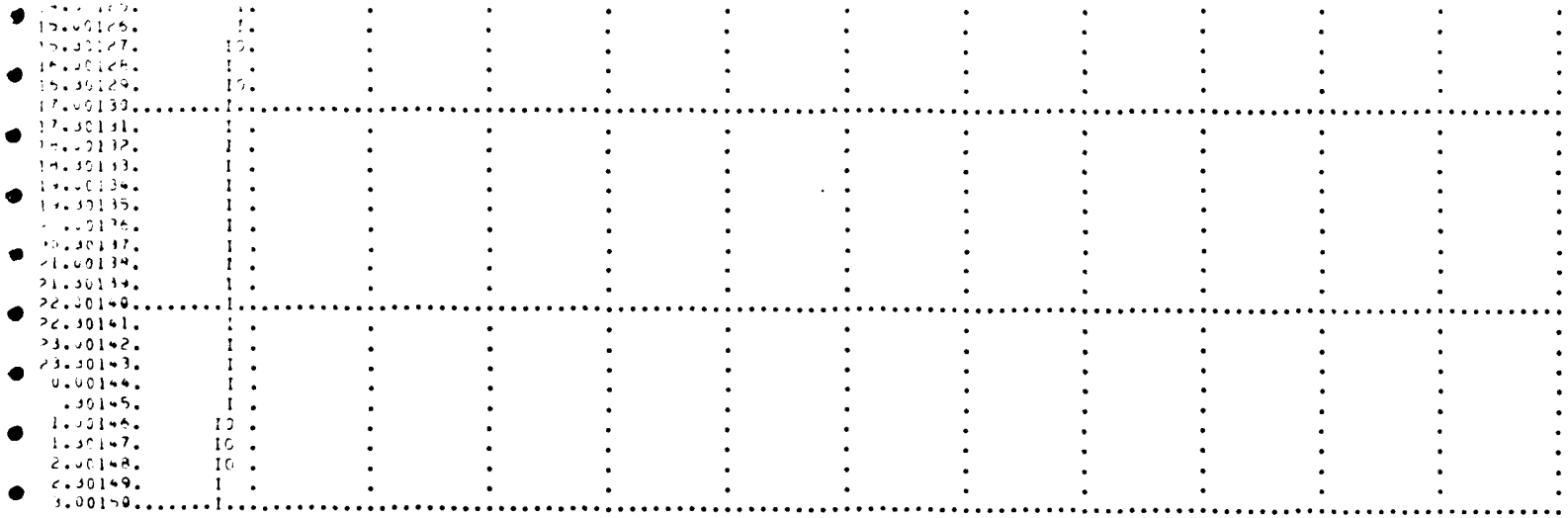
PEAK OUTFLOW IS 2016. AT TIME 44.00 HOURS

STATION 5

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)







PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .20	RATIO 3 .30	RATIO 4 .50	RATIO 5 .80	RATIO 6 1.00
HYDROGRAPH AT	1	3.11	1	708.	1417.	2125.	3542.	5668.	7085.
	(	8.05)	(	20.06)(	40.12)(	60.18)(	100.31)(	160.49)(	200.62)(
ROUTED TO	2	3.11	1	83.	214.	426.	1645.	3642.	5002.
	(	8.05)	(	2.35)(	6.07)(	12.07)(	46.59)(	103.13)(	141.63)(
HYDROGRAPH AT	3	.92	1	247.	494.	741.	1235.	1975.	2469.
	(	2.38)	(	6.99)(	13.98)(	20.98)(	34.96)(	55.94)(	69.92)(
2 COMBINED	4	4.03	1	280.	561.	865.	2016.	4571.	6353.
	(	10.44)	(	7.93)(	15.89)(	24.50)(	57.09)(	129.44)(	179.91)(
ROUTED TO	5	4.03	1	225.	477.	809.	2016.	4590.	6305.
	(	10.44)	(	6.38)(	13.52)(	22.92)(	57.08)(	129.96)(	178.53)(

BOWDISH RESERVOIR DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	569.00	569.00	572.00
STORAGE	0.	0.	716.
OUTFLOW	0.	0.	337.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	570.19	0.00	271.	83.	0.00	47.50	0.00
.20	571.23	0.00	525.	214.	0.00	47.00	0.00
.30	572.18	.18	761.	426.	5.00	46.00	0.00
.50	573.34	1.34	1050.	1645.	13.00	44.50	0.00
.80	574.57	2.57	1362.	3642.	21.00	44.00	0.00
1.00	575.26	3.26	1538.	5002.	35.00	43.50	0.00

CLARKVILLE POND DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	538.00	538.00	542.00
STORAGE	0.	0.	72.
OUTFLOW	0.	0.	611.

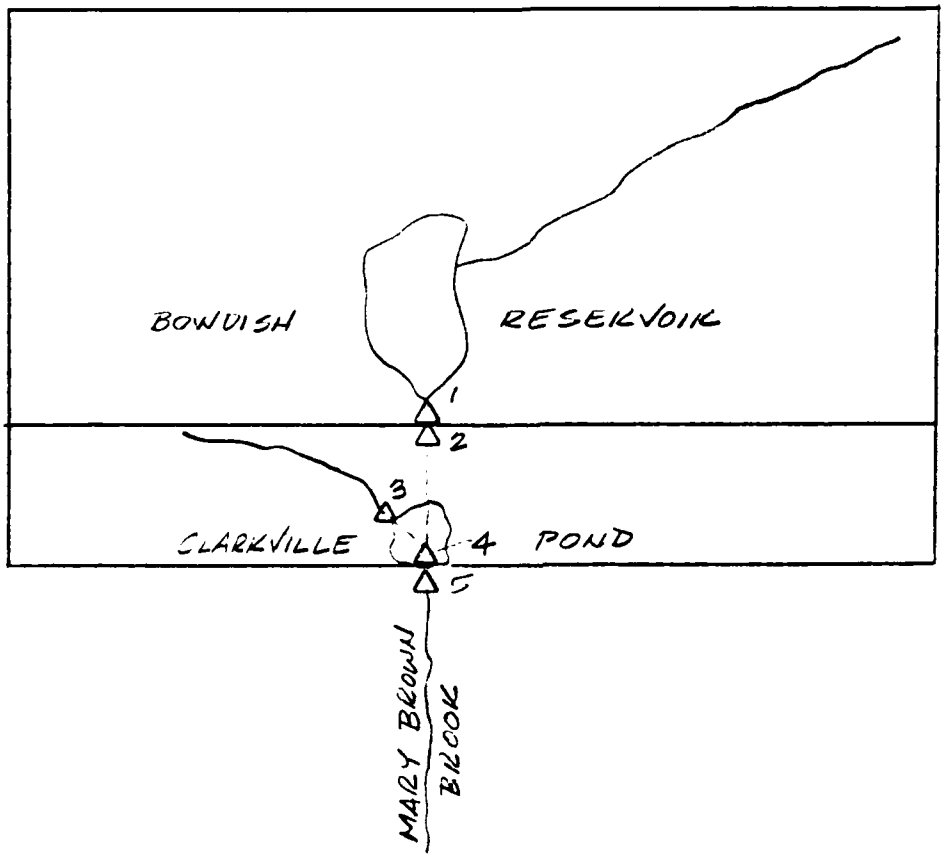
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	540.10	0.00	33.	225.	0.00	43.00	0.00
.20	541.34	0.00	57.	477.	0.00	43.00	0.00
.30	542.26	.26	78.	809.	2.50	42.50	0.00
.50	543.10	1.10	100.	2016.	10.50	44.00	0.00
.80	544.30	2.30	134.	4590.	14.50	43.50	0.00
1.00	544.95	2.95	154.	6305.	17.00	43.00	0.00

LENARD & DILAJ ENGINEERING, INC.
1066 Storrs Road
STORRS, CONNECTICUT 06268
(203) 429-7308

80-27-8

JOB CLARKVILLE POND DAM
SHEET NO 1 OF 7
CALCULATED BY K. A. DATE 1/27/81
CHECKED BY M.C. DATE 1/29/81
SCALE

SCHEMATIC



1- BOWDISH RESERVOIR INFLOW
2- " " " ROUTED THROUGH DAM
3- CLARKVILLE POND INFLOW
4- COMBINE HYDROGRAPHS 2 AND 3
5- COMBINED FLOW ROUTED THROUGH CLARKVILLE POND DAM.

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JOB CLARKVILLE POND DAM
SHEET NO 2 OF 7
CALCULATED BY K. A. DATE 1/27/81
CHECKED BY MR DATE 1/29/81
SCALE

WATERSHED AREA – BOWDISH RESERVOIR

CHEPACHET QUAD:

32 grads
32 "
33 " } 33 grads ⇒ 0.08 S.M

THOMPSON QUAD:

1329 grads
1328 grads } 1329 grads ⇒ 3.03 S.M.

(BOWDISH RESERVOIR) TOTAL 3.11 S.M.

WATERSHED AREA – CLARKVILLE POND

THOMPSON QUAD:

405 grads
403 "
405 " } 404 grads ⇒ 0.92 S.M.

(CLARKVILLE POND) TOTAL 0.92 S.M.

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JOB CLARKVILLE POND DAM 1
SHEET NO 3 OF 7
CALCULATED BY K. A. DATE 1/27/81
CHECKED BY M.R. DATE 1/28/81
SCALE

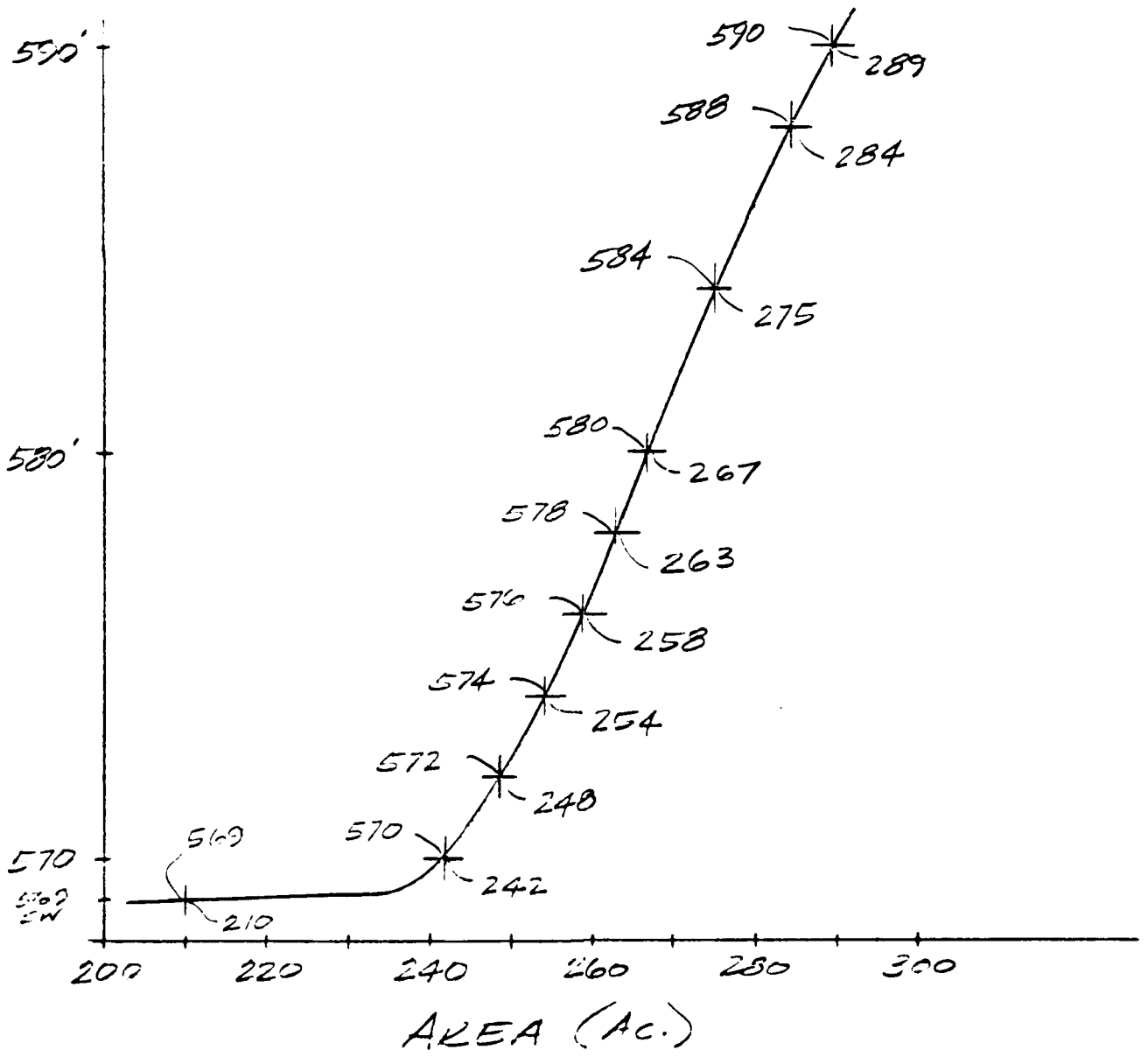
WATER SURFACE AREAS – BOWDISH RESERVOIR

ELEV. 569' (SPILLWAY): 210 Ac.

ELEV. 570' : 242 Ac.

ELEV. 580' : 267 Ac.

ELEV. 590' : 289 Ac.



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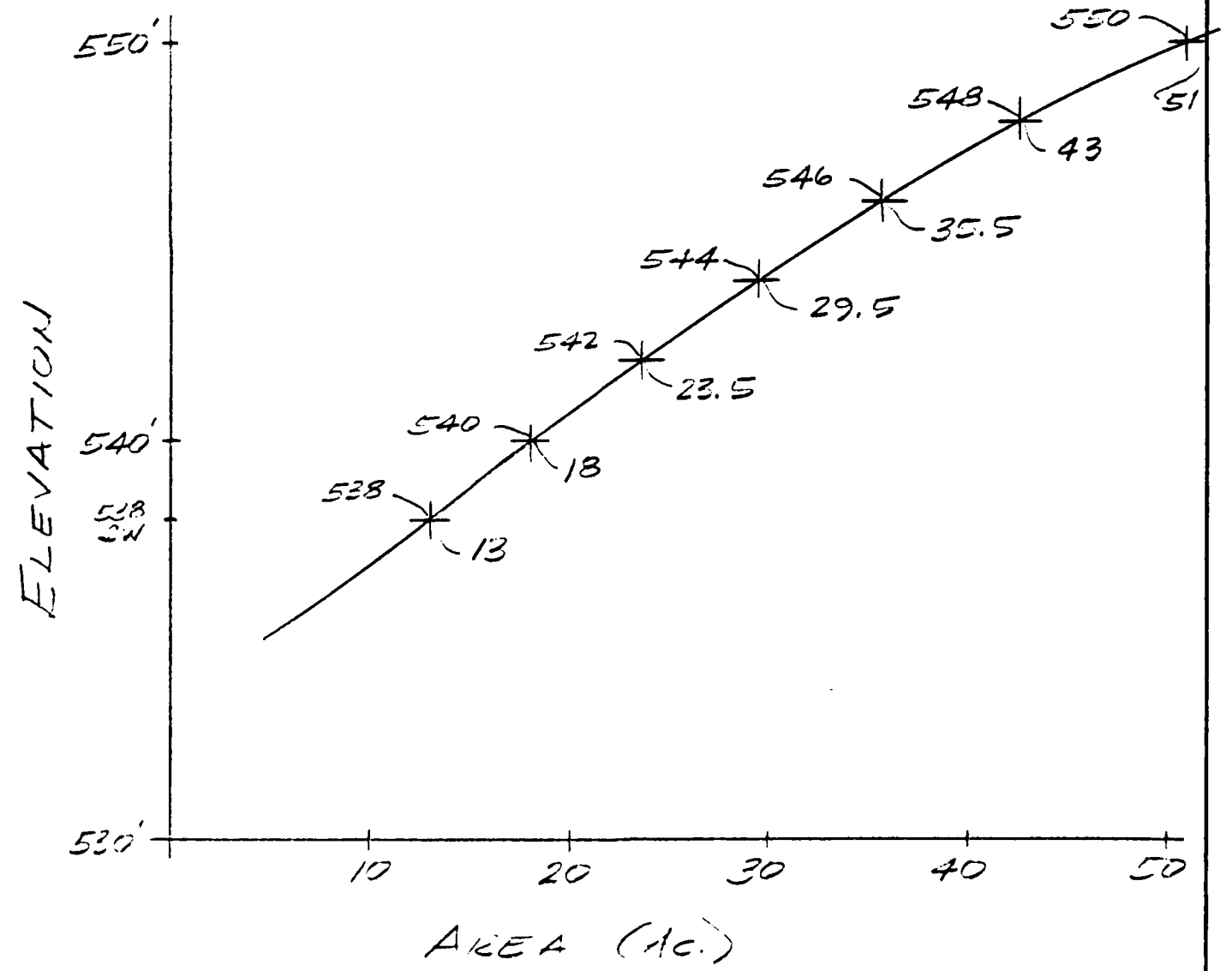
JOB CLARKVILLE POND DAM
SHEET NO 4 OF 7
CALCULATED BY K. A. DATE 1/27/81
CHECKED BY M. R DATE 1/28/81
SCALE

WATER SURFACE AREAS – CLARKVILLE POND

ELEV. 538' (SPILLWAY): 13 Ac.

ELEV. 540' : 18 Ac.

ELEV. 550' : 51 Ac.



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JOB CLACKVILLE POND DAM
SHEET NO 5 OF 7
CALCULATED BY K. A. DATE 1/27/81
CHECKED BY M R. DATE 1/28/81
SCALE

PRECIPITATION

U.S. WEATHER BUREAU
TECH. PAPER NO. 40

PMF - 6 HOUR — 24.5 INCHES

LAG TIME (SNYDER'S)

$$t_p = C_t (L L_{CA})^{0.3}$$

BOWLISH RESERVOIR:

$C_t = 2.0$
$L = 12,400' = 2.35$ MI.
$L_{CA} = 3,000' = 0.57$ MI.

$$t_p = 2.0[(2.35)(0.57)]^{0.3}$$

$t_p = 2.18$ HRS.

CLACKVILLE POND:

$C_t = 2.0$
$L = 7200' = 1.36$ MI.
$L_{CA} = 1800' = 0.34$ MI.

$$t_p = 2.0[(1.36)(0.34)]^{0.3}$$

$t_p = 1.59$ HRS.

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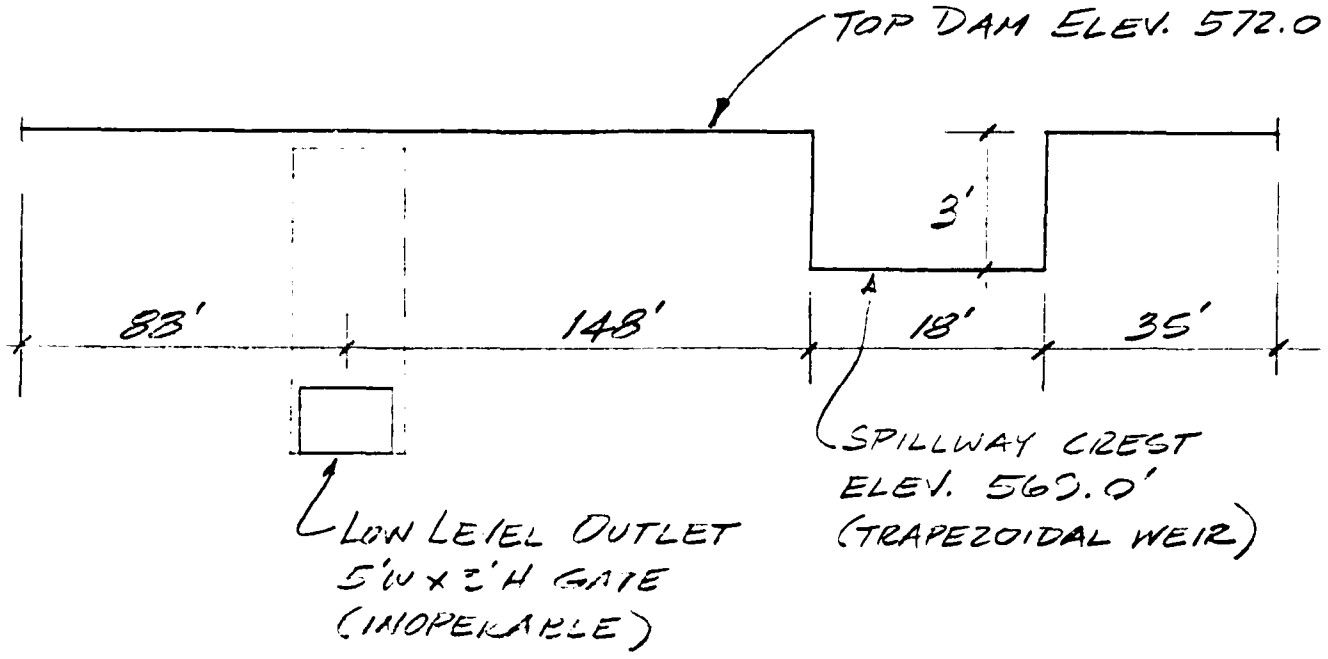
JOB CLARKVILLE POND DAM
SHEET NO 6 OF 7
CALCULATED BY K. A. DATE 1/27/81
CHECKED BY M. R. DATE 1/28/81
SCALE

BOWDISH RESERVOIR DAM



DAM LENGTH: L = TOTAL LENGTH − SPILLWAY
$L = 88' + 148' + 35'$ $L = 271'$

DISCHARGE COEFFICIENT OVER DAM: $C = 2.5$

SPILLWAY DISCHARGE: $Q = CLH^{1.5}$

ELEV.	C	L	H	Q (CFS)
569.0	3.4	18'	0	0
570.0	3.4		1	61
571.0	3.5		2	178
572.0	3.6		3	327
574.0	3.6		5	724
576.0	3.6		7	1200
578.0	3.6		9	1750
580.0	3.6	18'	11	2364

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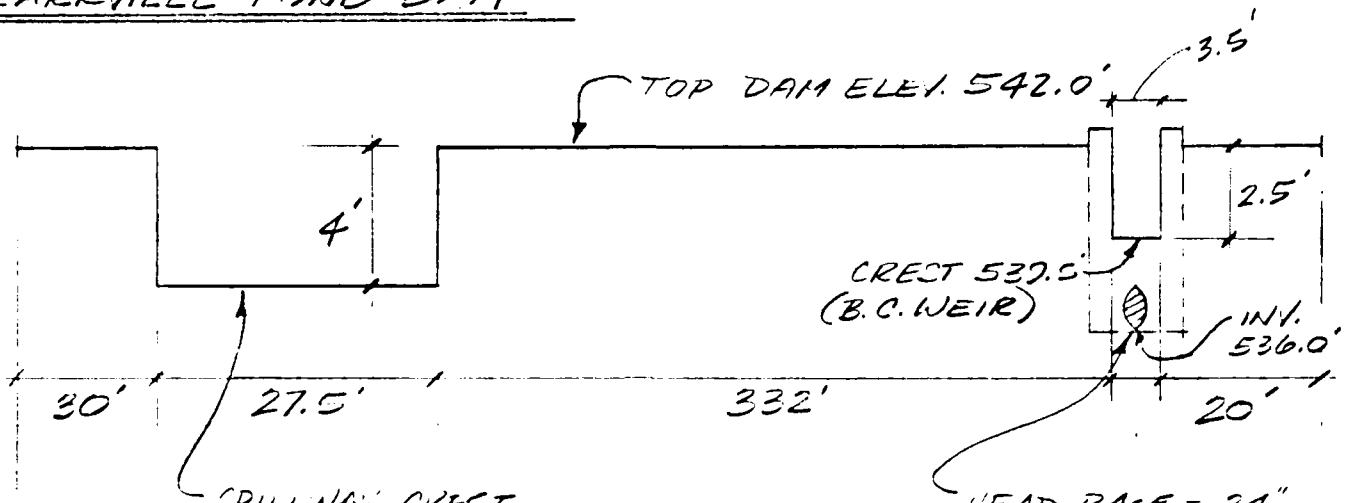
JOB CLARKVILLE POND DAM
SHEET NO 7 OF 7
CALCULATED BY K.A. DATE 1/27/81
CHECKED BY M.R. DATE 1/29/81
SCALE

CLARKVILLE POND DAM



DAM LENGTH: L = TOTAL LENGTH − SPILLWAY
$L = 30' + 332' + 20'$ $L = 382'$

DISCHARGE COEFFICIENT OVER DAM: $C = 2.5$

SPILLWAY & HEAD RACE DISCHARGE:

ELEV.	H	C	L	Q_S	H	C	L	Q_{HR}	Q_{TOTAL}
538.0	0	2.7	27.5	0	—	—	—	—	0
539.0	1	2.6		72	—	—	—	—	72
539.5	1.5	2.6		131	0	2.6	3.5	0	131
540.0	2.0	2.6		202	0.5	2.6		3	205
542.0	4.0	2.6		572	2.5	2.8		39	611
544.0	6.0	2.6		1051	4.5	3.3		110	1161
546.0	8.0	2.6		1618	6.5	3.3		191	1809
548.0	10.0	2.6		2261	8.5	3.3		286	2547
550.0	12.0	2.6	27.5	2972	10.5	3.3	3.5	393	3365

TEST FLOOD LEVEL − ½ PMF

542.1	5.1'		27.5	824	3.6	3.0	3.5	72	896

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JOB CLARKVILLE POND DAM
SHEET NO 1 OF 9
CALCULATED BY K. A. DATE 1/27/81
CHECKED BY M. D. DATE 2/18/81
SCALE

DAM FAILURE ANALYSIS:

DAM LENGTH = 413'

DAM LENGTH AT MID HEIGHT = 340'

PEAK FAILURE OUTFLOW:

$$Q_{P1} = \frac{8}{27} W_b \sqrt{g}\, y_o^{3/2}$$

$W_b = 0.4 \times 340' = 136'$

$g = 32.2\ FT/S^2$

$y_o = 14.0'$

$$Q_{P1} = \frac{8}{27}(136)\sqrt{32.2}\,(14.0)^{3/2}$$

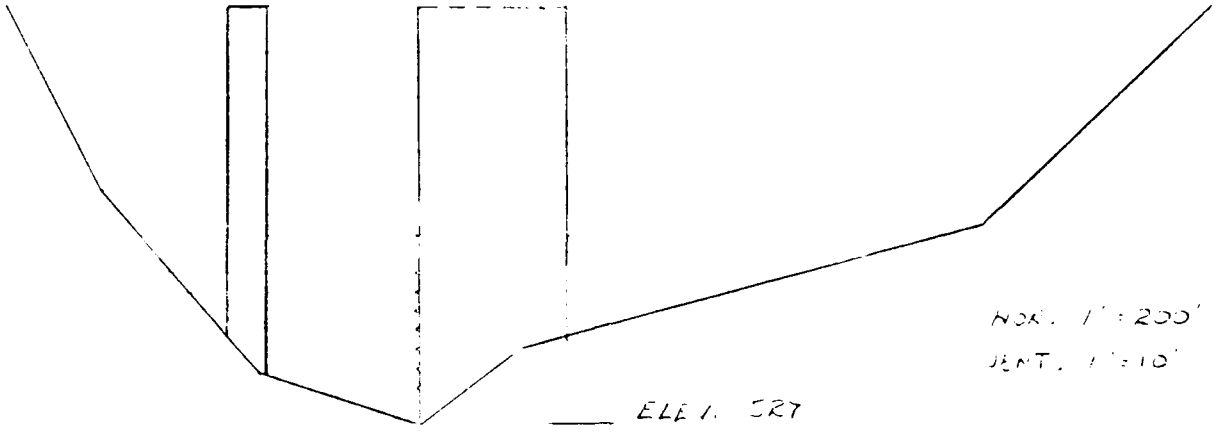
$Q_{P1} = 11,978\ CFS$

STORAGE (ASSUMED): 165 AC.-FT.

LENARD & DILAJ ENGINEERING, INC.
1066 Storrs Road
STORRS, CONNECTICUT 06268
(203) 429-7308

JOB CLARKVILLE POND DAM
SHEET NO R OF 9
CALCULATED BY GJS DATE 1/28/91
CHECKED BY K. A. DATE 2/17/91
SCALE

SECTION #1 - CLARKVILLE POND
STA 1+70



n = .022
S = .040
L = 170'

y	A	WP	R	V	Q

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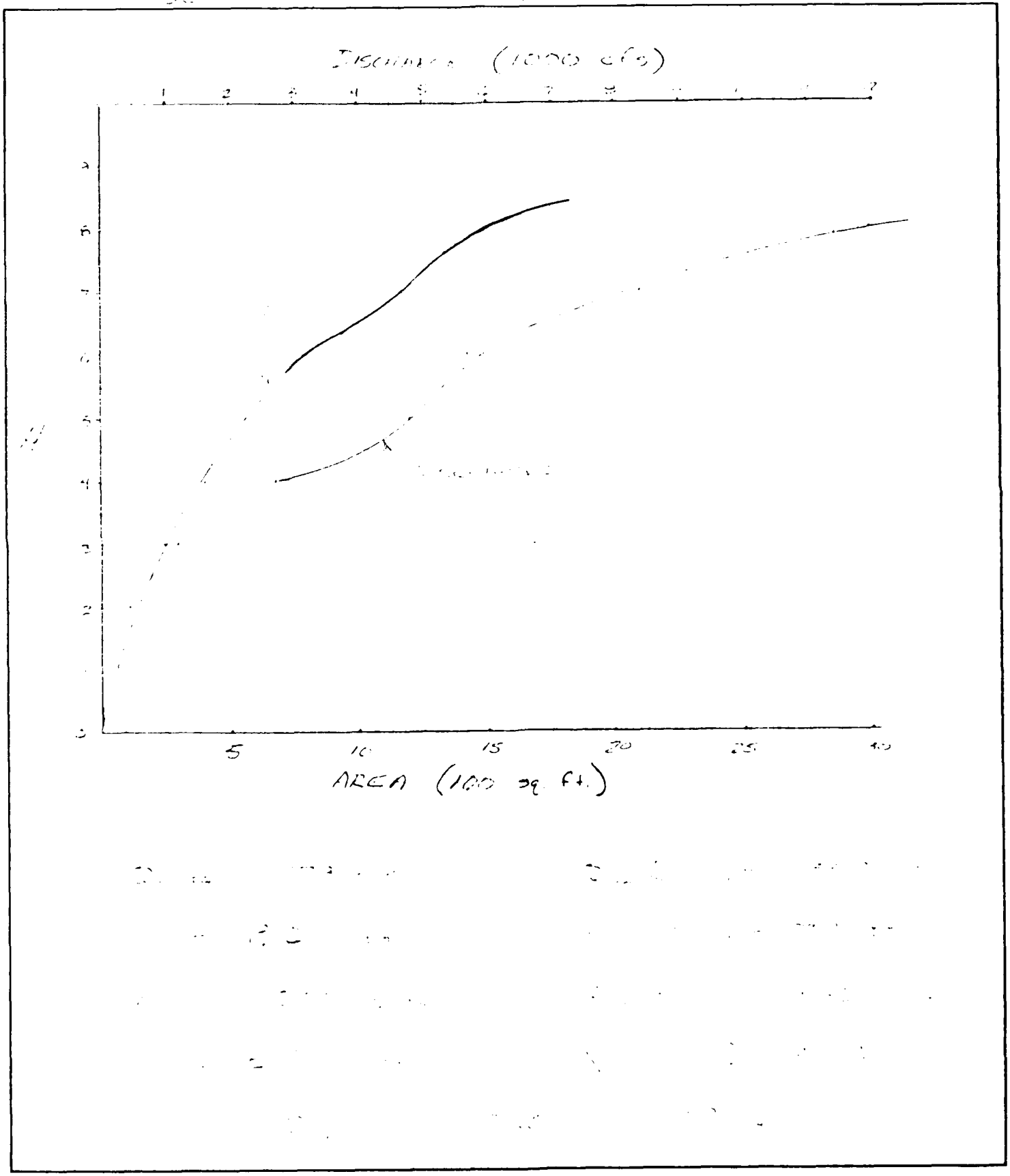
JOB CLARK VILLE DAM
SHEET NO 3 OF 57
CALCULATED BY MTC DATE 2/15/91
CHECKED BY K.A. DATE 2/15/91
SCALE



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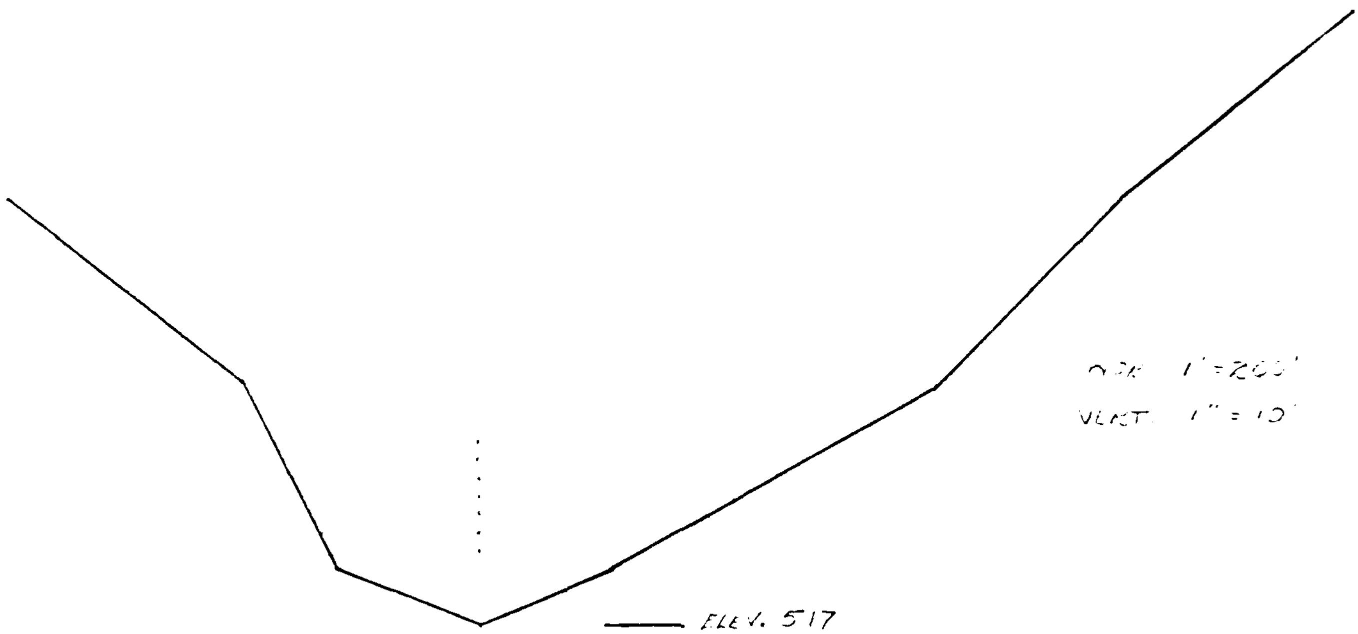
JOB: CLARKVILLE POND DAM

CALCULATED BY: G.E. DATE: 1/28/81
CHECKED BY: K.A. DATE: 2/18/81
SCALE:

SECTION # 2 - CLARKVILLE POND DAM
STA 9+70



n = 0.0[illegible]
s = 0.005 L = 800

H	A	WP	R	V	Q
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1386
6	[illegible]	430	[illegible]	2.7	[illegible]
8	[illegible]	[illegible]	[illegible]	3.6	8352
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

FORM 204-1 Available from NEBS Inc. Groton, Mass. 01471

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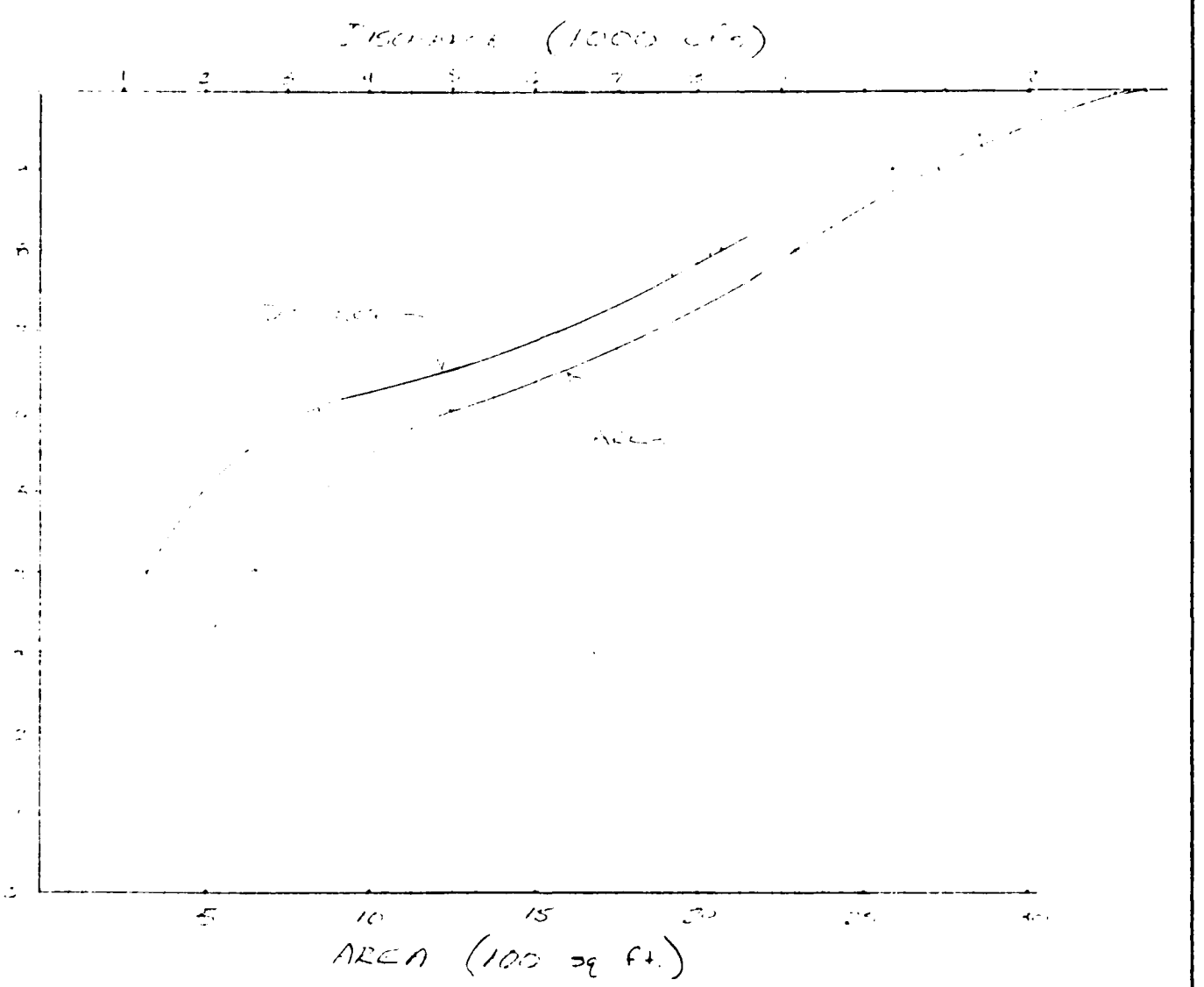
JOB

SHEET NO 5 OF

CALCULATED BY DATE

CHECKED BY K. A. DATE 2/13/81

SCALE



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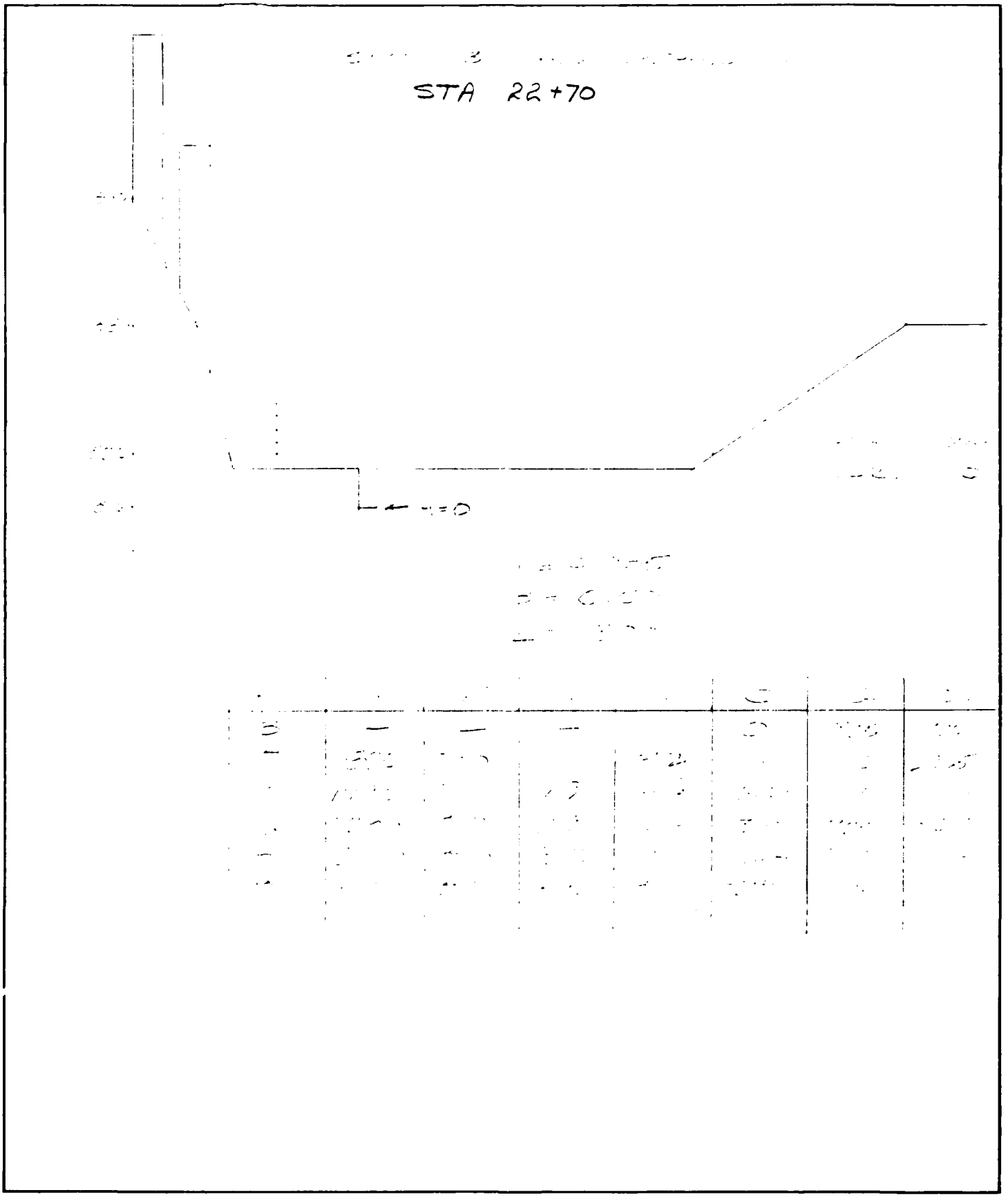
JOB CLARKEVILLE POND DAM

SHEET NO 6 OF 9

CALCULATED BY MR DATE 1/28/80

CHECKED BY K.A. DATE 2/18/81

SCALE



LENARD & DILAJ ENGINEERING, INC.
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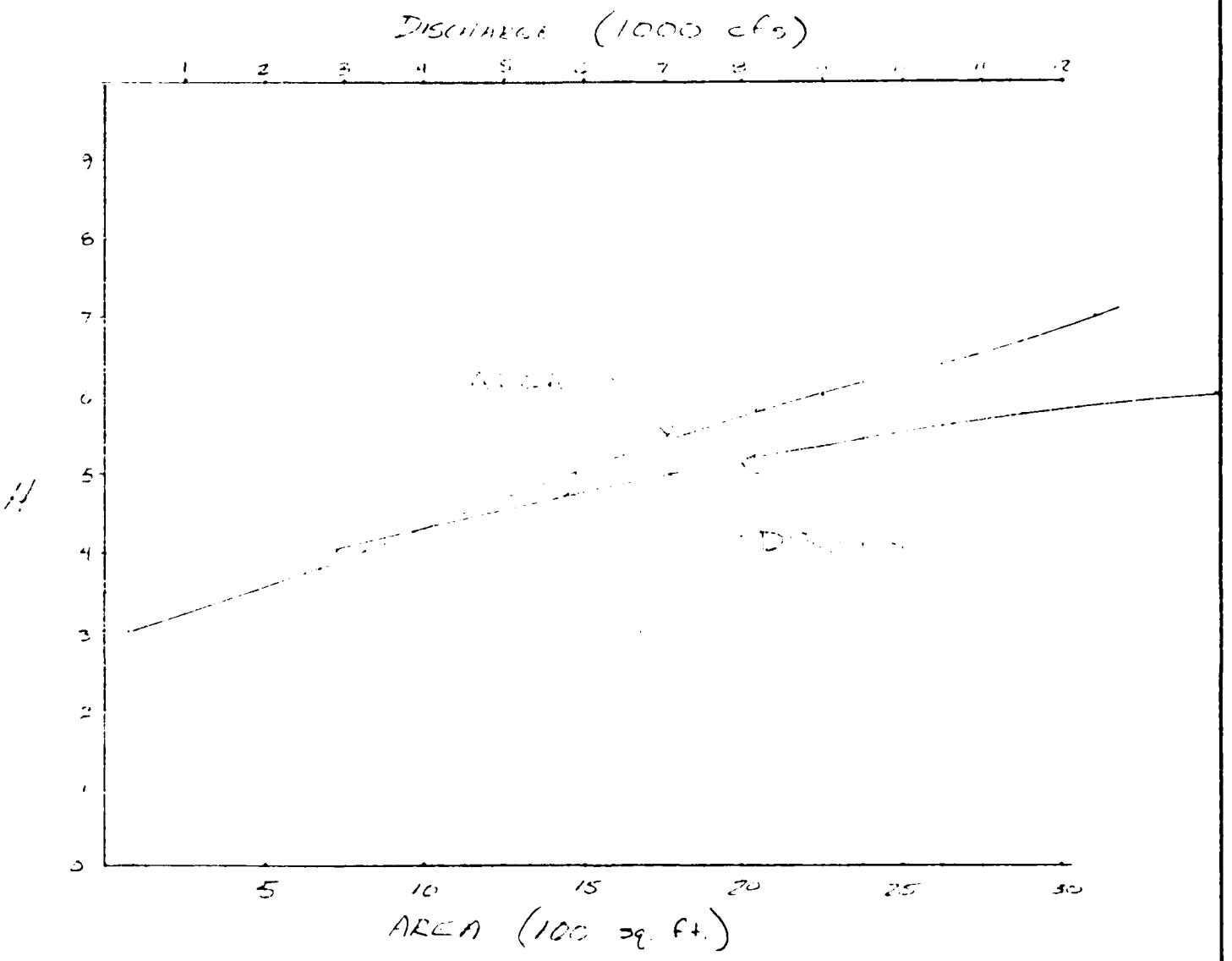
STORRS, CONNECTICUT 06268
(203) 429-7308

JOB [illegible] DAM
SHEET NO 1 OF 7
CALCULATED BY MLE DATE [illegible]
CHECKED BY KA DATE 2/18/91
SCALE



LENARD & DILAJ ENGINEERING, INC.
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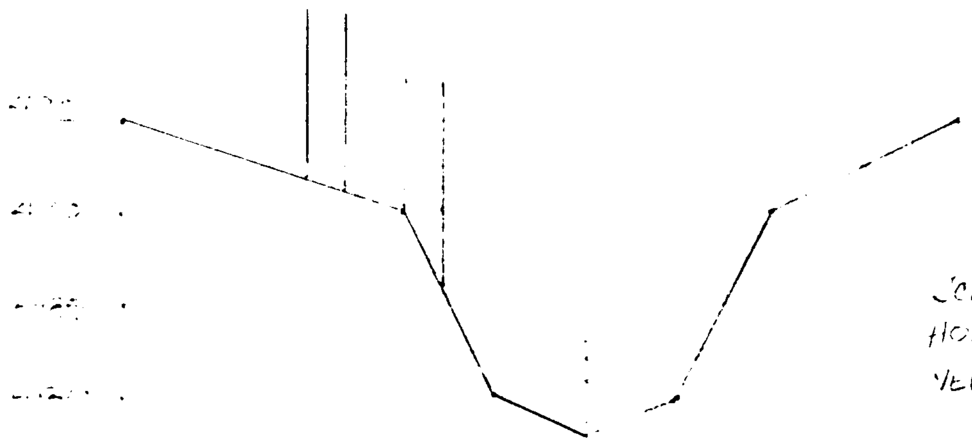
STORRS, CONNECTICUT 06268
(203) 429-7308

JOB [illegible] POND DAM
SHEET NO 8 OF 9
CALCULATED BY [illegible] DATE [illegible]
CHECKED BY K.A. DATE 2/18/81
SCALE

SECTION 4

STA 37+70



SCALE:
HOR. 1" = 200'
VERT. 1" = 10'

S = [illegible]
N = [illegible]
L = 1500

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	575	[illegible]	3.5	9.6	8400

FORM 204 Available from [illegible] Groton, Mass. [illegible]

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(203) 429-7308

JOB [illegible]

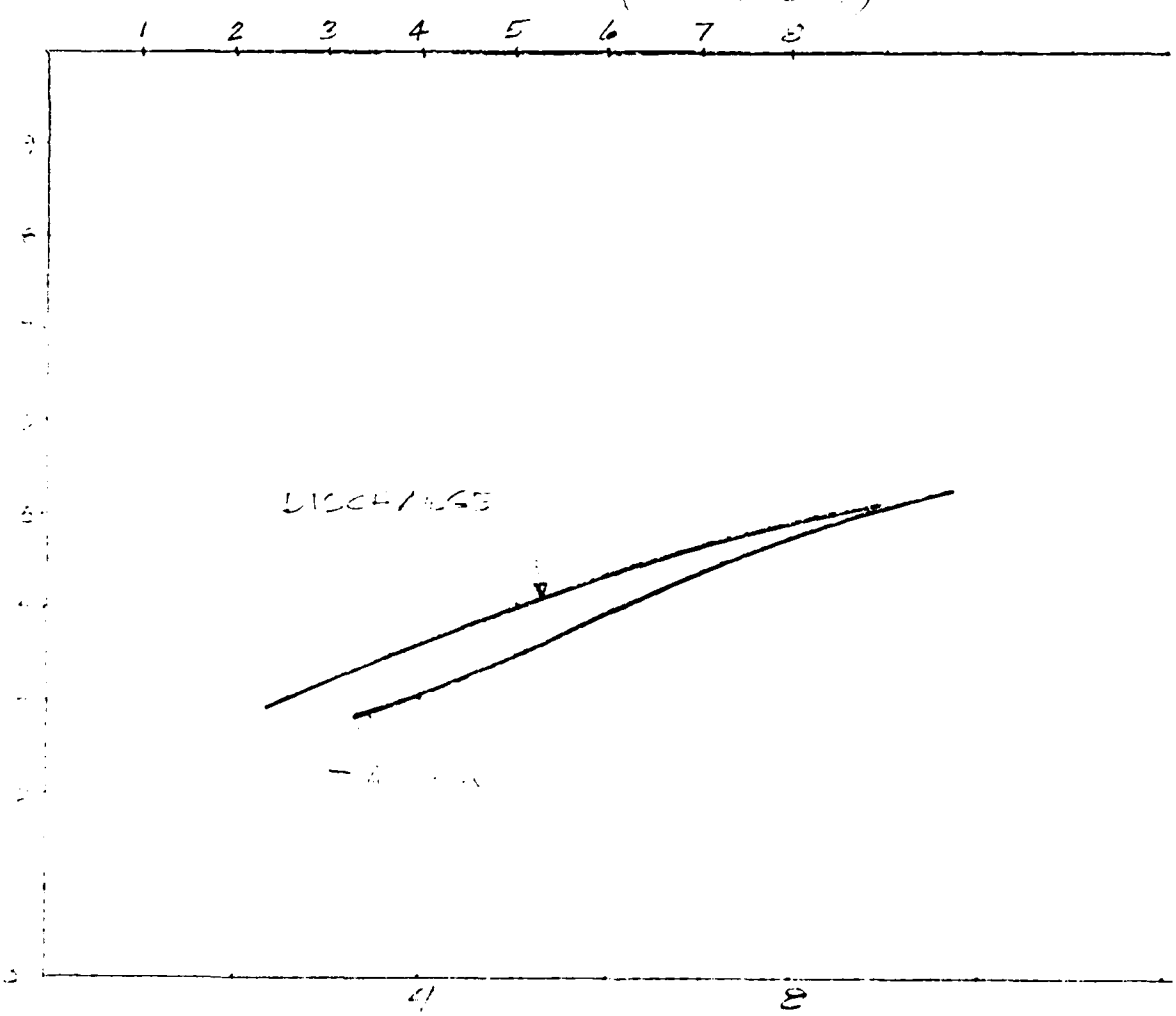
SHEET NO 9 OF 9

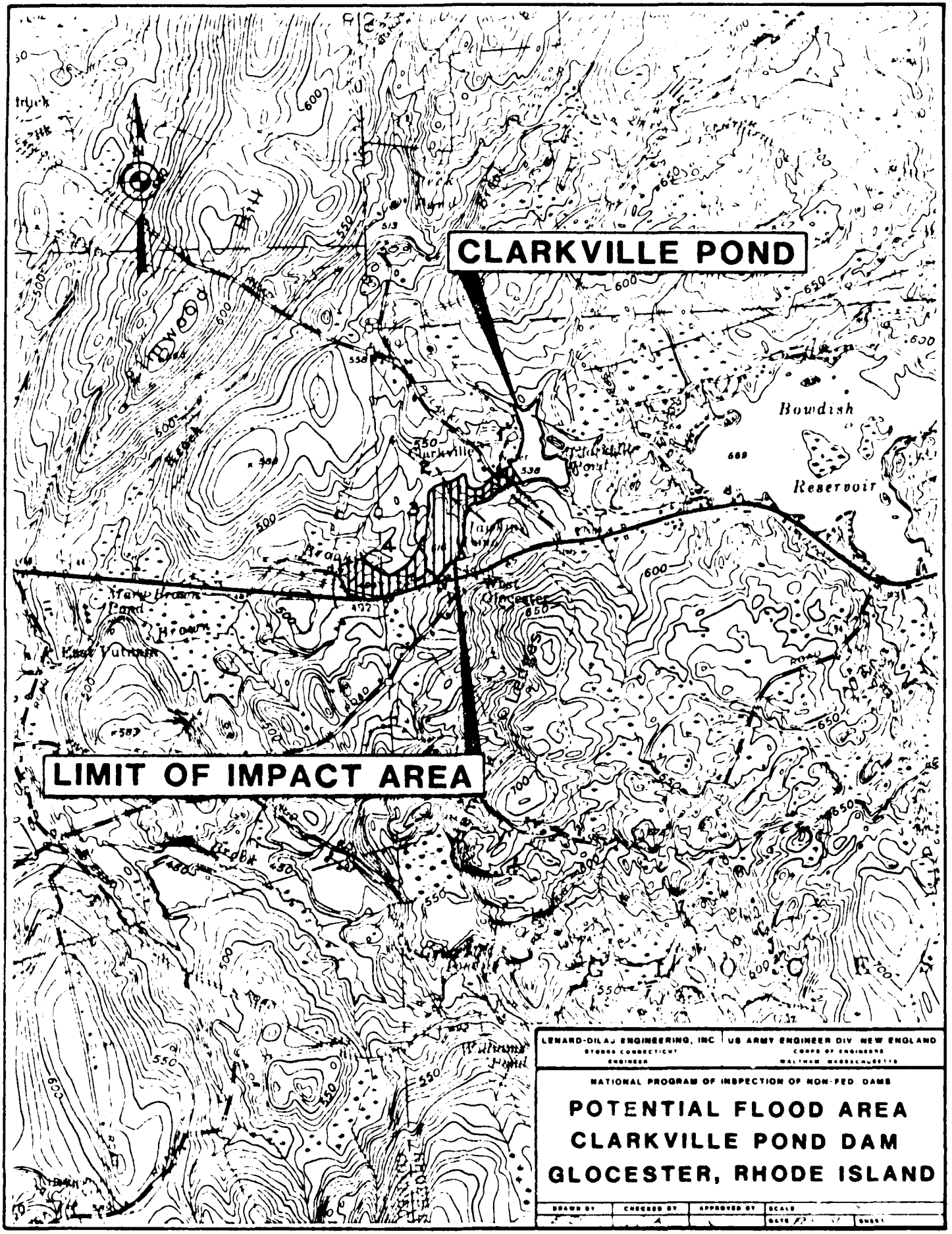
CALCULATED BY MC DATE 1/29/81

CHECKED BY K.A. DATE 2/13/81

SCALE

SECTION 4




CLARKVILLE POND
LIMIT OF IMPACT AREA
Bowdish
Reservoir
Clarkville
West Glocester
Pond
Brook
East Putnam
LENARD-DILAJ ENGINEERING, INC
ENGINEER
US ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS
POTENTIAL FLOOD AREA
CLARKVILLE POND DAM
GLOCESTER, RHODE ISLAND
DRAWN BY
CHECKED BY
APPROVED BY
SCALE
DATE
SHEET

APPENDIX E

INFORMATION AS CONTAINED IN THE

NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME

END

FILMED

8-85

DTIC